ENVIRONMENTAL ASSESSMENT

REDUCING BIRD DAMAGE IN THE STATE OF RHODE ISLAND

Prepared by:

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

In cooperation with:

UNITED STATES DEPARTMENT OF THE INTERIOR
UNITED STATES FISH AND WILDLIFE SERVICE
MIGRATORY BIRD PROGRAM
REGION 5

May 2013

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ACRONYMS

APHIS	Animal and Plant Health Inspection Service
AI	Avian Influenza
AMDUCA	Animal Medicinal Drug Use Clarification Act
AQDO	Aquaculture Depredation Order
AVMA	American Veterinary Medical Association
BBS	Breeding Bird Survey
BCR	Bird Conservation Region
CBC	Christmas Bird Count
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
DFW	Division of Fisheries and Wildlife
DNC	Dinitrocarbanilide
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FDA	Food and Drug Administration
FEIS	Final Environmental Impact Statement
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FONSI	Finding of No Significant Impact
FR	Federal Register
FY	Fiscal Year
HDP	4,4'-dinitrocarbanilide
HP	Highly Pathogenic
INAD	Investigational New Animal Drug
IPN	Infectious Pancreatic Necrosis
IUCN	International Union for Conservation of Nature and Natural Resources
LD	Median Lethal Dose
LC	Median Lethal Concentration
MA	Methyl Anthranilate
MANEM	Mid-Atlantic/New England/Maritime
MBTA	Migratory Bird Treaty Act
MOU	Memorandum of Understanding
MSMSS	Mid-Summer Mute Swan Survey
NAS	National Audubon Society
NASS	National Agricultural Statistics Service
NEFO	New England Field Office
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NWRC	National Wildlife Research Center
RIDEM	Rhode Island Department of Environmental Management
PL	Public Law
PRDO	Public Resource Depredation Order
ROD	Record of Decision
SOP	Standard Operating Procedure
SVC	Spring Viraemia of Carp
T&E	Threatened and Endangered
USC	United States Code
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
VHS	Viral Haemorrhagic Septicaemia
WS	Wildlife Services

CHAPTER 1: PURPOSE AND NEED FOR ACTION

1.1 PURPOSE

The United States Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), Wildlife Services (WS)[1] program in Rhode Island and the Migratory Bird Program within the United States Fish and Wildlife Service (USFWS)[2] continue to receive requests for assistance or anticipate receiving requests for assistance to alleviate or prevent damage occurring to agricultural resources, natural resources, and property, including threats to human safety associated with snow geese (*Chen caerulescens*), brant (*Branta bernicla*), mute swans (*Cygnus olor*), wood ducks (*Aix sponsa*), gadwalls (*Anas strepera*), American wigeons (*Anas americana*), American black ducks (*Anas rubripes*), mallards (domestic/wild) (*Anas platyrhynchos*), blue-winged teal (*Anas discors*), Northern shovelers (*Anas clypeata*), Northern pintails (*Anas acuta*), green-winged teal (*Anas crecca*), canvasbacks (*Aythya valisineria*), redheads (*Aythya americana*), ring-necked ducks (*Aythya collaris*), greater scaup (*Aythya marila*), lesser scaup (*Aythya affinis*), common eiders (*Somateria mollissima*), surf scoters (*Melanitta perspicillata*), white-winged scoters (*Melanitta fusca*), black scoters (*Melanitta americana*), long-tailed ducks (*Clangula hyemalis*), buffleheads (*Bucephala albeola*), common goldeneyes (*Bucephala clangula*), hooded mergansers (*Lophodytes cucullatus*), common mergansers (*Mergus merganser*), red-breasted mergansers (*Mergus serrator*), ruddy ducks (*Oxyura jamaicensis*), feral/free ranging domestic waterfowl[3], Northern bobwhites (*Colinus virginianus*), ring-necked pheasants (*Phasianus colchicus*), ruffed grouse (*Bonasa umbellus*), wild turkeys (*Meleagris gallopavo*), common loons (*Gavia immer*), pied-billed grebes (*Podilymbus podiceps*), horned grebes (*Podiceps auritus*), red-necked grebes (*Podiceps grisegena*), double-crested cormorants (*Phalacrocorax auritus*), great blue herons (*Ardea herodias*), great egrets (*Ardea alba*), snowy egrets (*Egretta thula*), little blue herons (*Egretta caerulea*), cattle egrets (*Bubulcus ibis*), green herons (*Butorides virescens*), black-crowned night-herons (*Nycticorax nycticorax*), yellow-crowned night-herons (*Nyctanassa violacea*), glossy ibises (*Plegadis falcinellus*), black vultures (*Coragyps atratus*), turkey vultures (*Cathartes aura*), ospreys (*Pandion haliaetus*), bald eagles (*Haliaeetus leucocephalus*), Northern harriers (*Circus cyaneus*), sharp-shinned hawks (*Accipiter striatus*), Cooper's hawks (*Accipiter cooperii*), Northern goshawks (*Accipiter gentilis*), red-shouldered hawks (*Buteo lineatus*), broad-winged hawks (*Buteo platypterus*), Swainson's hawks (*Buteo swainsoni*), red-tailed hawks (*Buteo jamaicensis*), rough-legged hawks (*Buteo lagopus*), American kestrels (*Falco sparverius*), merlins (*Falco* columbarius), peregrine falcons (*Falco peregrinus*), American coots (*Fulica americana*), black-bellied plovers (*Pluvialis squatarola*), American golden plovers (*Pluvialis dominica*), semi-palmated plovers (*Charadrius semipalmatus*), killdeer (*Charadrius vociferous*), American oystercatchers (*Haematopus palliates*), spotted sandpipers (*Actitis macularia*), solitary sandpipers (*Tringa solitaria*), greater yellowlegs (*Tringa melanoleuca*), willets (*Tringa semipalmata*), lesser yellowlegs (*Tringa flavipes*), upland sandpipers (*Bartramia longicauda*), whimbrels (*Numenius phaeopus*), ruddy turnstones (*Arenaria interpres*), sanderlings (*Calidris alba*), semi-palmated sandpipers (*Calidris pusilla*), Western sandpipers (*Calidris mauri*), least sandpipers (*Calidris minutilla*), white-rumped sandpipers (*Calidris fuscicollis*), pectoral sandpipers (*Calidris melantos*), purple sandpipers (*Calidris maritima*),

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

[2]The USFWS is responsible for managing and regulating bird species under the Migratory Bird Treaty Act (MBTA). The take of migratory birds is prohibited by the MBTA. However, the USFWS can issue depredation permits for the take of protected birds when certain criteria are met pursuant to the MBTA. Depredation permits are issued to take migratory birds to alleviate damage and threats of damage.

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

dunlins (*Calidris alpina*), buff-breasted sandpipers (*Tryngites suberficllis*), short-billed dowitchers (*Limnodromus griseus*), long-billed dowitchers (*Limnodromus scolopaceus*), American woodcocks (*Scolopax minor*), Wilson's snipes (*Gallinago delicata*), Iceland gulls (*Larus glaucoides*), lesser black-backed gulls (*Larus fuscus*), glaucus gulls (*Larus hyperboreus*), least terns (*Sternula antillarum*), common terns (*Sterna hirundo*), rock pigeons (*Columba livia*), mourning doves (*Zenaida macroura*), monk parakeets (*Myiopsitta monachus*), barn owls (*Tyto alba*), Eastern screech owls (*Megascops asio*), great horned owls (*Bubo virginianus*), snowy owls (*Bubo scandiacus*), barred owls (*Strix varia*), long-eared owls (*Asio otus*), short-eared owls (*Asio flammeus*), Northern saw-whet owls (*Aegolius acadicus*), common nighthawks (*Chordeiles minor*), Eastern whip-poor-wills (*Antrostomus vociferus*), chimney swifts (*Chaetura pelagica*), belted kingfishers (*Megaceryle alcyon*), red-headed woodpeckers (*Melanerpes erythrocephalus*), red-bellied woodpeckers (*Melanerpes carolinus*), yellow-bellied sapsuckers (*Sphyrapicus varius*), downy woodpeckers (*Picoides pubescens*), hairy woodpeckers (*Picoides villosus*), Northern flickers (*Colaptes auratus*), pileated woodpeckers (*Dryocopus pileatus*), Eastern phoebes (*Sayornis phoebe*), Eastern kingbirds (*Tyrannus tyrannus*), Northern shrikes (*Lanius excubitor*), blue jays (*Cyanocitta cristata*), American crows (*Corvus brachyrhynchos*), fish crows (*Corvus ossifragus*), common ravens (*Corvus corax*), horned larks (*Eremophila alpestris*), purple martins (*Progne subis*), tree swallows (*Tachycineta bicolor*), Northern rough-winged swallows (*Stelgidopteryx serripennis*), bank swallows (*Riparia riparia*), cliff swallows (*Hirundo pyrrhonota*), barn swallows (*Hirundo rustica*), black-capped chickadees (*Poecile atricapillus*), tufted titmice (*Baeolophus bicolor*), red-breasted nuthatches (*Sitta canadensis*), white-breasted nuthatches (*Sitta carolinensis*), brown creepers (*Certhia americana*), house wrens (*Troglodytes aedon*), Eastern bluebirds (*Sialia sialis*), American robins (*Turdus migratorius*), gray catbirds (*Durnetella carolinensis*), Northern mockingbirds (*Mimus polyglottos*), cedar waxwings (*Bombycilla cedrorum*), dark-eyed juncos (*Junco hyemalis*), snow buntings (*Plectrophenax nivalis*), lark buntings (*Calamospiza melanocorys*), house sparrows (*Passer domesticus*), grasshopper sparrows (*Ammodramus savannarum*), chipping sparrows (*Spizella passerina*), savannah sparrows (*Passerculus sandwichensis*), Northern cardinals (*Cardinalis cardinalis*), red-winged blackbirds (*Agelaius phoeniceus*), Eastern meadowlarks (*Sturnella magna*), European starlings (*Sturnus vulgaris*), common grackles (*Quiscalus quiscula*), brown-headed cowbirds (*Molothrus ater*), purple finches (*Carpodacus purpureus*), house finches (*Carpodacus mexicanus*), and American goldfinches (*Spinus tristis*).

All federal actions are subject to the National Environmental Policy Act (NEPA; Public Law 9-190, 42 USC 4321 et seq.), including the actions of WS[4] and the USFWS. The NEPA sets forth the requirement that all federal actions be evaluated in terms of their potential to significantly affect the quality of the human environment for the purpose of avoiding or, where possible, mitigating and minimizing adverse impacts. Federal activities affecting the physical and biological environment are regulated in part by the Council of Environmental Quality (CEQ) through regulations in 40 CFR 1500-1508. The NEPA and the CEQ guidelines generally outline five broad types of activities to be accomplished as part of projects conducted by a federal agency. Those five types of activities are public involvement, analysis, documentation, implementation, and monitoring.

Pursuant to the NEPA and the CEQ regulations, WS and the USFWS are preparing this Environmental Assessment (EA)[5] to document the analyses associated with proposed federal actions and to inform decision-makers and the public of reasonable alternatives capable of avoiding or minimizing adverse

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

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

effects. This EA will also serve as a decision-aiding mechanism to ensure that the policies and goals of the NEPA are infused into the actions of each agency. Preparing the EA will assist in determining if the proposed cumulative management of bird damage could have a significant impact on the environment based on previous activities conducted and based on the anticipation of conducting additional efforts to manage damage. Because the goal of WS would be to conduct a coordinated program to alleviate bird damage in accordance with plans, goals, and objectives developed to reduce damage, and because the program's goals and directives[6] would be to provide services when requested, within the constraints of available funding and workforce, it is conceivable that additional damage management efforts could occur. Thus, this EA anticipates those additional efforts and the analyses would be intended to apply to actions that may occur in any locale and at any time within Rhode Island as part of a coordinated program. This EA will also evaluate the issuance of depredation permits by the Migratory Bird Program within the USFWS for the take of protected bird species in Rhode Island pursuant to the Migratory Bird Treaty Act (MBTA) to alleviate damage or threats.

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

This EA analyzes the potential effects of bird damage management when requested, as coordinated between WS, the USFWS, and the Division of Fisheries and Wildlife (DFW) within the Rhode Island Department of Environmental Management (RIDEM). The analyses contained in this EA are based on information derived from WS' Management Information System, published documents (see Appendix A), interagency consultations, public involvement, and the analyses in the Final Environmental Impact Statement (FEIS) prepared by the USFWS and WS for the management of double-crested cormorants (USFWS 2003).

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

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

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

1.2 NEED FOR ACTION

Some species of wildlife have adapted to and have thrived in human altered habitats. Those species, in particular, are often responsible for the majority of conflicts between people and wildlife. Those conflicts often lead people to request assistance with reducing damage to resources and to reduce threats to human safety. Wildlife can have either positive or negative values depending on the perspectives and circumstances of individual people. In general, people regard wildlife as providing economic, recreational, and aesthetic benefits. Knowing that wildlife exists in the natural environment provides a positive benefit to some people. However, activities associated with wildlife may result in economic losses to agricultural resources, natural resources, property, and threaten human safety. Therefore, an awareness of the varying perspectives and values are required to balance the needs of people and the needs of wildlife. When addressing damage or threats of damage caused by wildlife, wildlife damage management professionals must consider not only the needs of those people directly affected by wildlife damage but a range of environmental, sociocultural, and economic considerations as well.

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

The alleviation of damage or other problems caused by or related to the behavior of wildlife is termed wildlife damage management and is recognized as an integral component of wildlife management (The Wildlife Society 1992). The imminent threat of damage or loss of resources is often sufficient for individual actions to be initiated and the need for damage management is derived from the specific threats to resources. Those animals have no intent to do harm. They utilize habitats (*e.g.*, reproduce, walk, forage, deposit feces) where they can find a niche. If their activities result in lost economic value of resources or threaten human safety, people characterize this as damage. When damage exceeds or threatens to exceed an economic threshold and/or poses a threat to human safety, people often seek assistance with resolving damage or reducing threats to human safety.

The threshold triggering a request for assistance is often unique to the individual person requesting assistance and can be based on many factors (*e.g.*, economic, social, aesthetics). Therefore, how damage is defined can often be unique to an individual person and damage occurring to one individual may not be considered damage by another individual. However, the use of the term "*damage*" is consistently used to describe situations where an individual person has determined the losses associated with wildlife is actual damage requiring assistance (*i.e.*, has reached an individual threshold). The term "*damage*" is most often defined as economic losses to resources or threats to human safety. However, damage could also include a loss in aesthetic value and other situations where the actions of wildlife are no longer tolerable to an individual person.

The need for action to manage damage and threats associated with birds in Rhode Island arises from requests for assistance[8] received by WS to reduce and prevent damage from occurring to four major categories. Those four major categories include agricultural resources, natural resources, property, and threats to human safety. WS has identified those bird species most likely to be responsible for causing damage to those four categories in the State based on previous requests for assistance and assessments of the threat of bird strike hazards at airports in the State. Table 1.1 lists WS' technical assistance projects involving bird damage or threats of bird damage to those four major resource types in Rhode Island from the federal fiscal year[9] (FY) 2006 through FY 2012. Table 1.1 does not include direct operational assistance projects conducted by WS where WS was requested to provide assistance through the direct application of methods.

Table 1.1 – Technical assistance projects conducted by WS in Rhode Island, FY 2006 to FY 2012†

Species	Projects	Species	Projects
American Crows	15	**American Golden Plovers**	2
Ospreys	8	**Upland Sandpipers**	2
House Sparrows	8	**Least Terns**	2
European Starlings	8	**Wild Turkeys**	2
Mallards	7	**Greater Yellowlegs**	2
Red-tailed Hawks	7	**Lark Buntings,**	1
Peregrine Falcons	4	**Double-crested Cormorants**	1
Rock Pigeons	4	**American Black Ducks**	1
Turkey Vultures	4	**Feral Ducks**	1
Unidentifiable Birds	3	**Bald Eagles**	1
Snow Buntings	3	**Great Egrets**	1
Mourning Doves	3	**Snowy Egrets**	1
American Kestrels	3	**Feral Geese**	1
Common Grackles	3	**Snow Geese**	1
Killdeer	3	**Ruffed Grouse**	1
Barn Swallows	3	**Cooper`s Hawks**	1
Mute Swans	3	**Eastern Meadowlarks**	1
Downy Woodpeckers	3	**Snowy Owls**	1
Hairy Woodpeckers	3	**Chipping Sparrows**	1
Red-winged Blackbirds	2	**Grasshopper Sparrows**	1
Brown-headed Cowbirds	2	**Savannah Sparrows**	1
Wood Ducks	2	**Bank Swallows**	1
Brants	2	**Cliff Swallows**	1
Great Blue Herons	2	**Tree Swallows**	1
Horned Larks	2	**Common Terns**	1
Purple Martins	2	**Black Vultures**	1
		TOTAL	**140**

†Table does not include direct operational assistance projects conducted by WS where WS was requested to provide assistance through the direct application of methods.

[8] WS would only conduct 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.

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

Technical assistance is provided by WS to those people requesting assistance with resolving damage or the threat of damage by providing information and recommendations on damage management activities that can be conducted by the requestor without WS' direct involvement in managing or preventing the damage. WS' technical assistance activities will be discussed further in Chapter 3 of this EA. The technical assistance projects conducted by WS are representative of the damage and threats that could be caused by birds in Rhode Island. Between FY 2006 and FY 2012, WS has conducted 140 technical assistance projects in Rhode Island that addressed damage and threats of damage associated with those bird species addressed in this assessment. American crows, ospreys, house sparrows, and European starling rank among bird species with the highest number of technical assistance projects conducted.

Table 1.2 lists those bird species and the resource types that those bird species can cause damage to in Rhode Island. Many of the bird species addressed in this EA can cause damage to or pose threats to a variety of resources. In Rhode Island, most requests for assistance received by WS are related to threats associated with those bird species being struck by aircraft at or near airports in the State. Bird strikes can cause substantial damage to aircraft requiring costly repairs. In some cases, bird strikes can lead to the catastrophic failure of the aircraft, which can threaten passenger safety.

Many of the species addressed in this assessment are gregarious (*i.e.*, form large flocks), especially during the fall and spring migration periods. Although damage and threats can occur throughout the year, damage or the threat of damage is 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 starlings. 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.

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

	Resource*					Resource			
Species	**A**	**N**	**P**	**H**	**Species**	**A**	**N**	**P**	**H**
Snow Geese	X		X	X	Pectoral Sandpipers			X	X
Brant			X	X	Purple Sandpipers			X	X
Mute Swans		X	X	X	Dunlins			X	X
Wood Ducks			X	X	Buff-breasted Sandpipers			X	X
Gadwall			X	X	Short-billed Dowitchers			X	X
American Wigeon			X	X	Long-billed Dowitchers			X	X
American Black Duck			X	X	Wilson's Snipe			X	X
Mallard	X		X	X	American Woodcocks			X	X
Blue-winged Teal			X	X	Iceland Gulls			X	X
Northern Shoveler			X	X	Lesser Black-backed Gulls			X	X
Northern Pintail			X	X	Glaucous Gulls			X	X
Green-winged Teal			X	X	Least Terns			X	X
Canvasback			X	X	Common Terns			X	X
Redhead			X	X	Rock Pigeons	X	X	X	X
Ring-necked Ducks			X	X	Mourning Doves			X	X
Greater Scaup			X	X	Barn Owls	X		X	X
Lesser Scaup			X	X	Eastern Screech-Owls			X	X
Common Eiders			X	X	Great Horned Owls	X	X	X	X
Surf Scoters			X	X	Snowy Owls			X	X
White-winged Scoters			X	X	Barred Owls	X	X	X	X
Black Scoters			X	X	Long-eared Owls			X	X

Species	Resource*				Species	Resource			
	A	N	P	H		A	N	P	H
Long-tailed Ducks			X	X	Short-eared Owls			X	X
Buffleheads			X	X	Northern Saw-whet Owls			X	X
Common Goldeneye			X	X	Common Nighthawks			X	X
Domestic Waterfowl	X	X	X	X	Eastern Whip-poor-wills			X	X
Hooded Mergansers	X		X	X	Chimney Swifts			X	X
Common Mergansers	X		X	X	Belted Kingfishers	X		X	X
Red-breasted Mergansers	X		X	X	Red-headed Woodpeckers			X	X
Ruddy Ducks			X	X	Red-bellied Woodpeckers			X	X
Northern Bobwhite			X	X	Yellow-bellied Sapsuckers			X	X
Ring-necked Pheasants	X		X	X	Downy Woodpeckers			X	
Ruffed Grouse			X	X	Hairy Woodpeckers			X	
Wild Turkeys	X		X		Northern Flickers			X	
Common Loons			X	X	Pileated Woodpeckers			X	X
Pied-billed Grebes			X	X	American Kestrels	X	X	X	X
Horned Grebes			X	X	Merlins	X	X	X	X
Red-necked Grebes			X	X	Peregrine Falcons	X	X	X	X
Double-crested Cormorants	X	X	X	X	Monk Parakeets	X	X	X	X
Great Blue Herons	X	X	X	X	Eastern Phoebes			X	X
Great Egrets	X	X	X	X	Eastern Kingbirds			X	X
Snowy Egrets	X	X	X	X	Northern Shrikes			X	X
Little Blue Herons	X	X	X	X	Blue Jays			X	X
Cattle Egrets	X	X	X	X	American Crows	X	X	X	X
Green Herons	X	X	X	X	Fish Crows	X	X	X	X
Black-crowned Night-Herons	X	X	X	X	Common Ravens	X	X	X	X
Yellow-crowned Night-Herons	X	X	X	X	Horned Larks			X	X
Glossy Ibises			X	X	Purple Martins			X	X
Black Vultures	X		X	X	Tree Swallows			X	X
Turkey Vultures	X		X	X	Northern Rough-winged Swallow			X	X
Ospreys	X	X	X	X	Bank Swallows			X	X
Bald Eagles			X	X	Cliff Swallows			X	X
Northern Harriers	X	X	X	X	Barn Swallows	X		X	X
Sharp-shinned Hawks	X	X	X	X	Black-capped Chickadees			X	X
Cooper's Hawks	X	X	X	X	Tufted Titmice			X	X
Northern Goshawks	X	X	X	X	Red-breasted Nuthatches			X	X
Red-shouldered Hawks	X	X	X	X	White-breasted Nuthatches			X	X
Broad-winged Hawks	X	X	X	X	Brown Creepers			X	X
Swainson's Hawks	X	X	X	X	House Wrens			X	X
Red-tailed Hawks	X	X	X	X	Eastern Bluebirds			X	X
Rough-legged Hawks	X	X	X	X	American Robins	X		X	X
American Coots			X	X	Gray Catbirds			X	X
Black-bellied Plovers			X	X	Northern Mockingbirds			X	X
American Golden Plovers			X	X	European Starlings	X	X	X	X
Semipalmated Plovers			X	X	Snow Buntings			X	X
Killdeer			X	X	Chipping Sparrows			X	X
American Oystercatcher			X	X	Lark Buntings			X	X
Spotted Sandpipers			X	X	Savannah Sparrows			X	X
Solitary Sandpipers			X	X	Grasshopper Sparrows			X	X
Greater Yellowlegs			X	X	Dark-eyed Juncos			X	X
Willets			X	X	Northern Cardinals			X	X
Lesser Yellowlegs			X	X	Red-winged Blackbirds	X		X	X
Upland Sandpipers			X	X	Eastern Meadowlarks			X	X

Species	Resource*				Species	Resource			
	A	N	P	H		A	N	P	H
Whimbrels			X	X	Common Grackles	X	X	X	X
Ruddy Turnstones			X	X	Brown-headed Cowbirds	X	X	X	X
Sanderlings			X	X	Purple Finches			X	X
Semipalmated Sandpipers			X	X	House Finches			X	X
Western Sandpipers			X	X	American Goldfinches			X	X
Least Sandpipers			X	X	House Sparrows	X	X	X	X
White-rumped Sandpipers			X	X					

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

Additional information regarding bird damage is discussed in the following subsections of the EA:

Need to Alleviate Bird Damage to Agricultural Resources

According to the National Agricultural Statistics Service (NASS), agriculture continues to be an important sector in the Rhode Island economy with the value of agricultural production totaling over $65,908,000 in 2007 (NASS 2009). Agricultural production occurs on 67,819 acres of land in Rhode Island on 1, 219 farms in 2007 (NASS 2009).

Livestock, dairy, and poultry products accounted for 15.6% of the agricultural cash receipts, worth $10,306,000 in the State during 2007. The top farm commodities for cash receipts were generated from the production of milk and other dairy products from cows, which accounted for 7.0% of the cash receipts worth $4,599,000 in the State. Poultry products and eggs together accounted for 2.9% of the cash receipts worth $1,908,000 in the State. Aquaculture accounted for 2.5% of the cash receipts worth $1,653,000 in the State.

Crops, including nursery and greenhouse account for 84.4% in cash receipts, worth $55,602,000 in Rhode Island during 2007. Nursery, greenhouse, floriculture, and sod account for most of this production and account for 61.8% of the total cash receipts in the State and were worth $ 40,739,000 in 2007 (NASS 2009). Other important crops include vegetables, melons, and potatoes, which accounts for 12.3% of the total cash receipts worth $8,111,000; and fruits, tree nuts and berries, which accounts for 6.8% of the total cash receipts worth $ 4,483,000 in the State (NASS 2009).

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

Damage to Aquaculture Resources

Damage to aquaculture resources occurs primarily from the economic losses associated with birds consuming fish and other commercially raised aquatic organisms. Damage can also result from the death of fish and other aquatic wildlife from injuries associated with bird predation as well as the threat of disease transmission from one impoundment to another or from one aquaculture facility to other facilities as birds move between sites. The principal species propagated at aquaculture facilities in Rhode Island are mollusks, ornamental fish, and trout (NASS 2009). In 2007, there were 24 commercial mollusk operations, two ornamental fish operations, and two trout operations in Rhode Island (NASS 2009). Additionally, there are four trout hatcheries owned and operated by the RIDEM DFW (RIDEM 2012*a*). Of those birds shown in Table 1.2 associated with damage to agriculture, of primary concern to aquaculture facilities in Rhode Island are double-crested cormorants, American crows, American black and mallard ducks, common eiders, common and hooded mergansers, great blue herons, green herons, black-crowned night-herons, and belted kingfishers.

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

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 cormorants have on the aquaculture industry can vary dependent upon many different variables including, the value of the fish stock, number of depredating birds present, and the time of year the predation is taking place.

In addition to cormorants, great blue herons are also known to forage at aquaculture facilities (Parkhurst et al. 1987). During a survey of aquaculture facilities in the northeastern United States, 76% of respondents identified the great blue heron as the bird of highest predation concern (Glahn et al. 1999*a*). Glahn et al. (1999*a*) found that 80% of the aquaculture facilities surveyed in the northeastern United States perceived birds as posing an economic threat due to predation, which coincided with 81% of the facilities surveyed having birds present on aquaculture ponds. Great blue herons were found at 90% of the sites surveyed by Glahn et al. (1999*a*). Loss of trout in ponds with herons present ranged from 9.1% to 39.4% in Pennsylvania with an estimated loss in production ranging from $8,000 to nearly $66,000 (Glahn et al. 1999*b*). The stomach contents of great blue herons collected at trout producing facilities in the northeastern United States contained almost exclusively trout (Glahn et al. 1999*b*). In addition to cormorants and herons, other bird species have also been identified as causing damage or posing threats to aquaculture facilities. In 1984, a survey of fish producing facilities identified 43 species of birds as foraging on fish at facilities, including mallards, osprey, red-tailed hawks, Northern harriers, owls, gulls, terns, American crows, mergansers, common grackles, and brown-headed cowbirds (Parkhurst et al. 1987).

Mallards have been identified by aquaculture facilities as posing a threat of economic loss from foraging behavior (Parkhurst et al. 1987, Parkhurst et al. 1992). During a survey conducted in 1984 of fisheries primarily in the eastern United States, managers at 49 of 175 facilities reported mallards as feeding on fish at those facilities, which represented an increase in the number of facilities reporting mallards as feeding on fish when compared to prior surveys (Parkhurst et al. 1987). Parkhurst et al. (1992) found mallards foraging on trout fingerlings at facilities in Pennsylvania. Mallards selected trout ranging in size from 8.9 centimeters to 12.2 centimeters in length. Once trout fingerlings reached a mean length of approximately 14 centimeters in raceways, mallards present at facilities switched to other food sources (Parkhurst et al. 1992). Of those predatory birds observed by Parkhurst et al. (1992), mallards consumed the most fish at the facilities with a mean of 148,599 fish captured and had the highest mean economic loss per year per site based on mallards being present at those facilities for a longer period of time per year compared to other species.

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

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

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

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

Birds have been identified as a possible source of transmission of three fish viruses in Europe: Spring Viraemia of Carp (SVC), Viral Haemorrhagic Septicaemia (VHS), and Infectious Pancreatic Necrosis (IPN) (European Inland Fisheries Advisory Commission 1989). VHS and IPN are known to occur in North America (Price and Nickum 1995). SVC has also been documented to occur in North America (USDA 2003). Peters and Neukirch (1986) found the IPN virus in the fecal droppings of herons when the herons were fed IPN infected trout. Olesen and Vestergard-Jorgensen (1982) found herons could transmit the VHS (Egtved virus) from beak to fish when the beaks of herons were contaminated with the virus. However, Eskildsen and Vestergard-Jorgensen (1973) found the Egtved virus did not pass through the digestive tracks into the fecal droppings of black-headed gulls (*Larus ridibundus*) when artificially inserted into the esophagus of the gulls.

Birds are also capable of passing bacterial pathogens through fecal droppings and on their feet (Price and Nickum 1995). The bacterial pathogen for the fish disease Enteric Septicemia of Catfish has been found within the intestines and rectal areas of great blue herons and double-crested cormorants from aquaculture

facilities in Mississippi (Taylor 1992). However, since Enteric Septicemia of Catfish is considered endemic in the region, Taylor (1992) did not consider birds as a primary vector of the disease. Birds also pose as primary hosts to several cestodes, nematods, trematodes, and other parasites that can infect fish. Birds can also act as intermediate hosts of parasites that can infect fish after completing a portion of their life cycle in crustaceans or mollusks (Price and Nickum 1995).

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

Damage and Threats to Livestock Operations

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

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

Economic damages associated with starlings and blackbirds feeding on livestock rations has been documented in France and Great Britain (Feare 1984), and in the United States (Besser et al. 1968, Dolbeer et al. 1978, Glahn and Otis 1981, Glahn 1983, Glahn and Otis 1986). 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 are most vulnerable to feeding by birds. Birds often select for those components of feed that are most beneficial to the desired outcome of livestock. When large flocks of birds selectively forage for components in livestock feeds, the composition and the energy value of the feed can be altered which can negatively affect the health and production of livestock. The removal of this high-energy source by European starlings is believed to reduce milk yields, weight gains, and is economically critical (Feare 1984). Glahn and Otis (1986) reported that starling damage was also associated with proximity to roosts, snow, freezing temperatures, and the number of livestock on feed.

The economic significance of feed losses to starlings and blackbirds has been demonstrated by Besser et al. (1968) who concluded that the value of losses in feedlots near Denver, Colorado was $84 per 1,000 birds in 1967. Forbes (1995) reported European starlings consume up to 50% of their body weight in feed each day. Glahn and Otis (1981) reported losses of 4.8 kg of pelletized feed consumed per 1,000 bird minutes. Glahn (1983) reported that 25.8% of farms in Tennessee experienced starling depredation problems of which 6.3% experienced considerable economic loss. Williams (1983) estimated seasonal feed losses to five species of blackbirds (primarily brown-headed cowbirds) at one feedlot in south Texas at nearly 140 tons valued at $18,000.

In addition, large concentrations of birds feeding, roosting, and/or loafing at livestock operations increase risks of disease transmission from fecal matter being deposited in areas where livestock feed, water, and are housed. Carlson et al. (2010) found *Salmonella enterica* in the gastrointestinal tract of starlings at cattle feedlots in Texas and suggested starlings could contribute to the contamination of cattle feed and water. Birds feeding in open troughs on livestock feed leave fecal deposits which can be consumed by feeding livestock, fecal matter can also be deposited in sources of water for livestock which increases the likelihood of disease transmission, and can contaminate other surface areas where livestock can encounter fecal matter deposited by birds. Many bird species, especially those encountered at livestock operations, are known to carrying infectious diseases, which can be excreted in fecal matter. Accumulations of fecal matter not only poses a risk to individual livestock operations but can be a source of transmission to other livestock operations as birds move from one area to another. LeJeune et al. (2008) found that starlings could play a role in the transmission of *Escherichia coli* between dairy farms.

Although birds are known to be carriers of diseases (vectors) that are transmissible to livestock, the rate that transmission occurs is unknown but is likely to be low. Since many sources of disease transmission exist, identifying a specific source can be difficult. Birds are known to be vectors of disease, which increases the threat of transmission when large numbers of birds are defecating and contacting surfaces and areas used by livestock. The rate of transmission is likely very low; however, the threat of transmission exists since birds are known vectors of many diseases transmittable to livestock. A number of diseases that affect livestock have been associated with rock pigeons, European starlings, and house sparrows (Weber 1979). Rock pigeons, starlings, and house sparrows have been identified as carriers of several bacteria that are known to cause diseases in livestock and pets, including erysipeloid, salmonellosis, pasteurellosis, avian tuberculosis, streptococcosis, vibrosis, and listeriosis (Weber 1979, Carlson et al. 2010). Weber (1979) also reported pigeons, starlings, and house sparrows as vectors of several viral, fungal, protozoal, and rickettsial diseases that are known to infect livestock and pets.

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). While both turkey vultures and black vultures have been documented harassing expectant cattle, damages are primarily attributed to black vultures. Vulture predation on livestock is distinctive. Black vultures killed pigs by pulling their eyes out followed by attacks to the rectal area or directly attacking the rectal area (Lovell 1947, Lovell 1952, Lowney 1999). During a difficult delivery, vultures will peck at the half-expunged calf and kill it. Although reports of calf depredation by vultures may occur, the WS program in Rhode Island has not previously received requests for assistance associated with vultures injuring or killing calves.

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

Damage to Agricultural Crops

Besser (1985) estimated damage to agricultural crops associated with birds exceeded $100 million annually in the United States. Bird damage to agricultural crops occurs primarily from the consumption of crops (*i.e.*, loss of the crop and revenue), but also consists of trampling of emerging crops and compaction of soil by waterfowl, consumption of cover crops used prevent erosion and condition soil, damage to fruits associated with feeding, and fecal contamination. In 2007, cash receipts from agricultural crops accounted for nearly 85% of the cash receipts from all agricultural commodities (crop and livestock) in Rhode Island. Of the agricultural crops produced in the State, Nursery, greenhouse, floriculture and sod ranked first in cash receipts received during 2007 followed by vegetables, melons and potatoes, and fruits, tree nuts, and berries (USDA 2009). Other crop commodities harvested in 2007 include corn and hay. Damage to agricultural crops in Rhode Island occurs primarily from American crows, red-winged blackbirds, grackles, cowbirds, European starlings, and to a lesser extent mallards, woodpeckers, ravens, American robins and other songbirds. Starlings feed on numerous types of fruits such as, cherries, figs, blueberries, apples, apricots, grapes, nectarines, peaches, plums, persimmons, strawberries, and olives (Weber 1979). Wildlife damage to apples, grapes, and blueberries has been estimated at $41 million annually, with most of the damage attributed to birds (USDA 1999).

Fruit and nut crops can be damaged by robins, starlings, red-winged blackbirds, grackles, cowbirds, woodpeckers, and crows. Besser (1985) estimated bird damage to grapes, cherries, and blueberries exceeded $1 million dollars annually in the United States. In 1972, Mott and Stone (1973) estimated that birds caused $1.6 to $2.1 million in damage to the blueberry industry in the United States, with starlings, robins, and grackles causing the most damage. Red-winged blackbirds, cowbirds, 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 or from knocking the berries from the bushes (Besser 1985). During a survey conducted in 15 states and British Columbia, Avery et al. (1992) found that 84% of respondents to the survey considered bird damage to blueberries to be "*serious*" or "*moderately serious*". Respondents of the survey identified starlings, robins, and grackles as the primary cause of damage (Avery et al. 1992). Avery et al. (1992) estimated bird damage to blueberry production in the United States cost growers $8.5 million in 1989.

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

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

Damage can also occur to sprouting corn as birds pull out the sprout or dig the sprout up to feed on the seed kernel (Besser 1985). Damage to sprouting corn occurs primarily from grackles and crows but red-winged blackbirds and common ravens are known to cause damage to sprouting corn (Stone and Mott 1973). Additionally, starlings may pull sprouting grains and feed on planted seed (Johnson and Glahn

1994). Damage to sprouting corn is likely localized and highest in areas where breeding colonies of grackles exist in close proximity to agricultural fields planted with corn (Stone and Mott 1973, Rogers 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 of grackles.

The most common waterfowl damage to agriculture is crop consumption, but also consists of unacceptable accumulations of feces on pastures, trampling of emerging crops, and increased erosion and runoff from fields where the cover crop has been grazed. Waterfowl graze a variety of crops, including oats, wheat, corn, soybeans, and alfalfa. Associated costs with agricultural damage involving waterfowl include costs to replant grazed crops, implement wildlife management practices, purchase replacement food sources, and decreased yields.

WS personnel have observed common ravens damaging potatoes used for production of potato chips in neighboring Massachusetts. Ravens would probe the soil until a potato was located, clear the soil, and peck holes into individual potatoes in the ground or after pulling them from the ground. Potatoes with pecked holes were unsuitable for harvest (T. Cozine, WS, personal observation 2004).

Need to Alleviate Threats that Birds Pose to Human Safety

Several bird species listed in Table 1.2 can be closely associated with human habitation and often exhibit gregarious behavior (*i.e.*, found together in large numbers), such as vultures, waterfowl, pigeons, crows, swallows, house sparrows, monk parakeets, grackles, cowbirds, starlings, 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 were struck by aircraft, excessive droppings can be aesthetically displeasing, accumulations of nesting material can pose a fire risk in buildings and on electrical transmission structures, and aggressive behavior, primarily from raptors and waterfowl, can pose risks to human safety.

Threat of Disease Transmission

Birds can play a role in the transmission of diseases where humans may encounter fecal droppings of those birds. Few studies are available on the occurrence of zoonotic diseases in wild birds and on the risks to humans from transmission of those diseases (Clark and McLean 2003). Study of this issue is complicated by the fact that some disease-causing agents associated with birds may also be contracted from other sources. The risk of disease transmission from birds to humans is likely very low. However, human exposure to fecal droppings through direct contact or through the disturbance of fecal droppings where disease organisms are known to occur increases the likelihood of disease transmission. The gregarious behavior of bird species leads to accumulations of fecal droppings that can be considered a threat to human health and safety due to the close association of those species of birds with human activity. Accumulations of bird droppings in public areas are aesthetically displeasing and are often in areas where humans may come in direct contact with fecal droppings.

Birds can play a role in the transmission of zoonotic diseases to humans such as Eastern equine encephalitis, St. Louis encephalitis, West Nile virus, psittacosis, and histoplasmosis. Public health officials and residents at such sites express concerns for human health related to the potential for disease transmission where fecal droppings accumulate. Fecal droppings that accumulate from large communal bird roosts can facilitate the growth of disease organisms, which grow in soils enriched by bird excrement, such as the fungus *Histoplasma capsulatum*, which causes the disease histoplasmosis in humans (Weeks and Stickley 1984). The disturbance of soil or fecal droppings under bird roosts where fecal droppings have accumulated can cause *H. capsulatum* to become airborne. Once airborne, the fungus could be inhaled by people in the area. Workers at an ethanol plant in eastern Nebraska became ill

with Histoplasmosis after breathing in spores from construction in an area that had a starling roost (Mortality and Morbidity Weekly Report 2004). Ornithosis (*Chlamydia psittaci*) is another respiratory disease that can be contracted by humans, livestock, and pets. 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.

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

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 has been isolated from the gastrointestinal tract of starlings (Carlson et al. 2010). 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). The serological type of *E. coli* that is best known is *E. coli* O157:H7, which is usually associated with cattle (Gallien and Hartung 1994). Many communities monitor water quality at swimming beaches and lakes, but lack the financial resources to pinpoint the source of elevated fecal coliform counts. When fecal coliform counts at swimming beaches exceed established standards, the beaches are 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., *E. coli*, *Listeria* spp., and *Salmonella* spp. (MacDonald and Brown 1974, Fenlon 1981, Butterfield et al. 1983, Monaghan et al. 1985, Norton 1986, Vauk-Hentzelt et al. 1987, Quessey and Messier 1992). Transmission of bacteria from gulls to humans is difficult to document; however, Reilly et al. (1981) and Monaghan et al. (1985) both suggested that gulls were the source of contamination for cases of human salmonellosis. Gulls can threaten the safety of municipal drinking water sources by potentially causing dangerously high levels of coliform bacteria from their fecal matter. Contamination

of public water supplies by gull feces has been stated as the most plausible source for disease transmission (*e.g.*, Jones et al. 1978, Hatch 1996). Gull feces has also been implicated in accelerated nutrient loading of aquatic systems (Portnoy 1990), which could have serious implications for municipal drinking water sources.

Public health concerns often arise when gulls, pigeons, starlings, and house sparrows 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. Starlings, pigeons, and house sparrows feeding on vegetable crops and livestock feed can potentially aid in the transmission of salmonella.

While transmission of diseases or parasites from birds to humans has not been well documented, the potential exists (Luechtefeld et al. 1980, Wobeser and Brand 1982, Hill and Grimes 1984, Pacha et al. 1988, Blandespoor and Reimink 1991, Graczyk et al. 1997, Saltoun et al. 2000, Kassa et al. 2001). In some cases, infections may even be life threatening for people with compromised or suppressed immune systems (Roffe 1987, Graczyk et al. 1998). Even though many people are concerned about disease transmission from feces, the probability of contracting a disease from feces is believed to be small. 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 methods to reduce transmission risks. WS recognizes and defers to the authority and expertise of local and State health officials in determining what does or does not constitute a threat to public health.

Situations in Rhode Island where the threat of disease associated with birds might occur could be exposure of residents to a bird roost which has been in a residential area for more than three years; disturbance of a large deposit of droppings in an attic where a flock of birds routinely roosts or nests; accumulated droppings from roosting birds on structures at an industrial site where employees must work in areas of fecal accumulation; birds nesting or loafing around a food court area of a recreational facility or other site where humans eat in close proximity to concentrated numbers of birds; or birds depositing waste from landfills in urban, suburban, and other nearby areas.

Threat of Aircraft Striking Wildlife at Airports and Military Bases

In addition to threats of zoonotic diseases, birds also pose a threat to human safety from being struck by aircraft. Birds struck by aircraft, especially when ingested into engines, can lead to structural damage to the aircraft and can cause catastrophic engine failure. The civil and military aviation communities have acknowledged that the threat to human health and safety from aircraft collisions with wildlife is increasing (Dolbeer 2000, MacKinnon et al. 2001). Collisions between aircraft and wildlife are a concern throughout the world because wildlife strikes threaten passenger safety (Thorpe 1996), result in lost revenue, and repairs to aircraft can be costly (Linnell et al. 1996, Robinson 1996). Aircraft collisions with wildlife can also erode public confidence in the air transportation industry as a whole (Conover et al. 1995). In several instances, wildlife-aircraft collisions in the United States have resulted in human fatalities. From 1990 through 2012, a total of 553 bird strikes have been reported by aircraft in Rhode Island (Federal Aviation Administration 2013) resulting in $73,500 in damages to aircraft and 1,195 hours of aircraft down time (Federal Aviation Administration 2013).

Target bird species can represent a threat to aviation safety. Threats can occur when large flocks or flight lines of birds enter or exit a roost at or near airports or when present in large flocks foraging on or near an airport. Vultures and raptors can also present a risk to aircraft because of their large body mass and slow-flying or soaring behavior. Vultures are considered the most hazardous bird for an aircraft to strike based on the frequency of strikes, effect on flight, and amount of damage caused by vultures throughout the

country (Dolbeer et al. 2000). Mourning doves also present risks when their late summer behaviors include creating large roosting and loafing flocks. Their feeding, watering, and gritting behavior on airport turf and runways further increases the risk of bird-aircraft collisions.

From 1990 to 2011, 119,917 wildlife strikes have been reported to the Federal Aviation Administration in the United States (Dolbeer et al. 2012). Birds were involved with over 97% of those reported strikes to civil aircraft in the United States (Dolbeer et al. 2012). The number of bird strikes actually occurring is likely to be much greater since Dolbeer (2009) estimated 39% of civil wildlife strikes are actually reported. In Rhode Island, over 97% of the reported aircraft strikes have involved birds (Federal Aviation Administration 2013). Aircraft in Rhode Island have struck at least 44 species of birds and 16 species groups based on strike reports (Federal Aviation Administration 2013). Of these, 20 species and two species groups have been positively identified by the Smithsonian Institution's Feather Identification Laboratory (Federal Aviation Administration 2013). Generally, bird collisions occur when aircraft are near the ground during take-off and approach to the runway. From 1990 through 2010, approximately 76% of reported bird strikes to general aviation aircraft in the United States occurred when the aircraft was at an altitude of 500 feet above ground level or less. Additionally, approximately 97% occurred less than 3,500 feet above ground level (Dolbeer et al. 2012).

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

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

Additional Human Safety Concerns Associated with Birds

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

In addition to raptors, waterfowl can also aggressively defend their nests and nestlings during the nesting season and may threaten or attack pets, children, and adults (Smith et al. 1999). In April 2012, a man drowned in Des Plains, Illinois when he was attacked by a mute swan that knocked him out of his kayak (Golab 2012).

Feral waterfowl often nest in high densities in areas used by people, such as industrial areas or recreational area (*e.g*., 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 their pets. Additionally, slipping hazards can be created by the buildup of feces from birds on docks, walkways, and other foot traffic areas. If fecal droppings occur in areas with foot traffic, slipping could occur resulting in injuries to people. To avoid those conditions, regular cleanup is often required to alleviate threats of slipping on fecal matter, which can be economically burdensome.

Human safety concerns due to monk parakeet nesting on electrical utility poles and transmission structures also exist. These include the possible loss of power to critical care facilities, risk of injury to maintenance crews, and increased incentives to and risks of trespassing. In some service areas, distribution poles with lines connecting to residences have signs indicating that the resident is on some type of life support system requiring continuous power. Nests on these poles or nearby distribution feeders pose a significant risk to these residents. Crews taking down nests are also at increased risk of injury and need to be protected from nest materials that contain mites and other insects that can cause itching and discomfort. Because of the trade in monk parakeets in the pet industry, it is common for people to trap monk parakeets and to sell them to pet shops and other individuals. Wild caught monk parakeets can be sold to pet owners and a number of electrocutions have occurred to individuals who have trespassed and climbed into substations to trap monk parakeets (Newman et al. 2004).

Need to Alleviate Bird Damage Occurring to Property

As shown in Table 1.2, all of the bird species addressed in this assessment are known to cause damage to property in Rhode Island. Property damage can occur in a variety of ways and can result in costly repairs and clean-up. Bird damage to property occurs through direct damage to structures, through roosting behavior, and through their nesting behavior. One example of direct damage to property occurs when vultures tear roofing shingles or pull out latex caulking around windows. Accumulations of fecal droppings can cause damage to buildings and statues. Woodpeckers also cause direct damage to property through excavating holes in buildings either for nesting purposes, attracting a mate, or to locate food which can remove insulation and allows water and other wildlife to enter the building. Direct damage can also result from birds that act aggressively toward their reflection in mirrors and windows, which can scratch paint and siding. Aircraft striking birds can also cause substantial damage requiring costly repairs and aircraft downtime.

Property Damage to Aircraft from Bird Strikes

Target bird species can present a safety threat to aviation when those species occur in large flocks or flight lines entering or exiting a roost at or near airports or when present in large flocks foraging on airport property. 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).

Gulls, raptors, waterfowl, and doves are the bird groups most frequently struck by aircraft in the United States. When struck, 27% of the reported gull strikes resulted in damage to the aircraft or had a negative

effect on the flight while 66% of the reported waterfowl strikes resulted in damage or negative effects on the flight compared to 26% of strikes involving raptors and 12% of strikes involving pigeons and doves (Dolbeer et al. 2012). Since 1990, over $150 million in damages to civil aircraft have been reported from strikes involving waterfowl (Dolbeer et al. 2012). In total, aircraft strikes involving birds has resulted in over $394 million in reported damages to civil aircraft since 1990 in the United States (Dolbeer et al. 2012).

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

Other Property Damage Associated with Birds

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

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, playgrounds, school grounds, and cemeteries. Property damage most often involves goose 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 wildlife management methods, loss of property use, loss of aesthetic value of flowers, gardens, and lawns consumed by waterfowl, loss of customers or visitors irritated by walking in fecal droppings, repair of golf greens, and replacing grazed turf. The costs of reestablishing overgrazed lawns and cleaning waterfowl feces from sidewalks have been estimated at more than $60 per bird (Allan et al. 1995). Property losses associated with cormorants include impacts to privately owned lakes that are stocked with fish; damage to boats and marinas or other properties found near cormorant breeding or roosting sites; and damage to vegetation on privately owned land (USFWS 2003).

Accumulated bird droppings can reduce the functional life of some building roofs by 50% (Weber 1979). Corrosion damage to metal structures and painted finishes, including those on automobiles, can occur because of the uric acid found in bird droppings. Electrical utility companies frequently have problems

with birds and bird droppings causing power outages by shorting out transformers and substations. This can result in outage time for power companies and consumers. Damage can also occur from droppings entering into food items or contaminating surfaces used to prepare food items at manufacturing facilities and can introduce undesirable components into the materials used in manufacturing processes.

The nesting behavior of some bird species can also cause damage to property. Nesting material can be aesthetically displeasing and fecal droppings often accumulate near nests, which can also be aesthetically displeasing. Many bird species are colonial nesters meaning they nest together in large numbers. Many of the gull, cormorant, egret, and heron species as well as monk parakeets addressed in this assessment nest in large colonies. Swallows can also nest in large colonies. Colonies of gulls nesting on building rooftops has been well documented. The presence of nesting gulls on rooftops can cause damage to urban and industrial structures. Nesting gulls peck at spray-on-foam roofing and rubber roofing material, including caulking. This creates holes that must be repaired or leaks in the roof can result. Gulls transport large amounts of nest material and food remains to the rooftops, which can obstruct roof drainage systems and lead to structural damage or roof failure if clogged drains result in rooftop flooding (Vermeer et al. 1988, Blokpoel and Scharf 1991, Belant 1993). Nesting material and feathers can also clog ventilation systems resulting in cleaning and repairs. During the annual molt, herring gull feathers can accumulate in piles over a meter in depth on rooftops (T. Cozine, WS, personal observation 2006).

Monk parakeets build large colonial nests from sticks in trees and on utility poles. Monk parakeet nests can cause decrease in electric reliability, equipment damage, lost revenue from nest and bird caused power outages, increase in operation and maintenance costs associated with nest removal and repair of damaged structures, and public safety concerns. Monk nests attract predators (including humans) that also can cause outages. Problems with nesting on utility structures have been reported in Rhode Island, New York, New Jersey, Colorado, Florida, and Texas (Buhler et al. 2001, Nehls 2002, Newman et al. 2004). If their nests are built on light or electrical utility poles, the bulbs or transformers can overheat, causing fires and blackouts. The weight of a nest can cause its support, such as a tree or man-made structure, to collapse (Stafford 2003). For example, for a five-month period in 2001, 198 electrical outages related to monk parakeets were logged, which affected over 10,000 customers in two counties in South Florida (Newman et al. 2004). The frequency of outages increases during wet weather. These outages result from nesting material completing an electric circuit between two energized parts or an energized part and a grounded part of electrical equipment. In some cases, the nests get too large and complete an electric circuit. In other cases, individual monks can bring nesting materials that can result in completing a circuit. Fires can start in the nesting material causing damage to transformers and other utility equipment (Newman et al. 2004). Monk Parakeet nests, in their native range, can grow up to over 200 chambers, with some weighing up to 1,180 kg (2,600 lbs) (Burgio 2012). In Rhode Island, nests range from one to twenty chambers in size, weighing up to 41 kg (90 lbs). These nests can result in damage to ornamental trees when they become too heavy to support or because of increased susceptibility to wind damage resulting in broken branches. Falling nests can damage buildings, automobiles and other property.

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

Habitat degradation in Rhode Island occurs primarily in areas where colonial waterbirds nest or where the gregarious roosting behavior of birds occurs. The degradation of habitat occurs from the continuous accumulation of fecal droppings that occurs under nesting colonies of birds or under areas where birds consistently roost. Over time, the accumulation of fecal droppings under areas where colonial waterbirds nest, such as cormorants and herons, can lead to the loss of vegetation due to the ammonium nitrogen found in the fecal droppings of birds. As an example, ammonium toxicity from fecal droppings of cormorants may be an important factor contributing to the declining presence of vegetation on some islands in the Great Lakes (Hebert et al. 2005). 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 10 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). For example, the establishment of cormorant colonies on islands in the Great Lakes could threaten the unique vegetative characteristic of many of those islands (Hebert et al. 2005). In some cases, the establishment of colonial waterbird nesting colonies on islands has led to the complete denuding of the island of vegetation. The removal of vegetation can lead to an increase in erosion of the island and can be aesthetically displeasing to recreational users.

Lewis (1929) considered the killing of trees by nesting cormorants to be local and limited, with most trees having no commercial timber value. However, tree damage may be perceived as a problem if those trees are rare species, or aesthetically valued (Bédard et al. 1999, Hatch and Weseloh 1999). In addition to habitat degradation, nesting colonial waterbirds can adversely affect other wildlife species. Cormorants are known to displace other colonial nesting bird species such as black-crowned night-herons, egrets, great blue herons, gulls, common terns, and Caspian terns through habitat degradation and nest site competition (USFWS 2003). Cuthbert et al. (2002) examined potential impacts of cormorants on great blue herons and black-crowned night-herons in the Great Lakes and found that cormorants have not negatively influenced breeding distribution or productivity of either species at a regional scale, but did contribute to declines in heron presence and increases in site abandonment in certain site-specific circumstances.

Cormorants can have a negative effect on vegetation that provides nesting habitat for other birds (Jarvie et al. 1999, Shieldcastle and Martin 1999) and wildlife, including State and federally listed T&E species (Korfanty et al. 1999). Cuthbert et al. (2002) found that cormorants have a negative effect on normal plant growth and survival on a localized level in the Great Lakes region. Wires and Cuthbert (2001) identified vegetation die off as an important threat to 66% of the colonial waterbird sites designated as conservation sites of priority in the Great Lakes of the United States. Of the 29 conservation sites reporting vegetation die off as a threat, Wires and Cuthbert (2001) reported cormorants were present at 23 of those sites. Based on survey information provided by Wires et al. (2001), biologists in the Great Lakes region reported cormorants as having an impact to herbaceous layers and trees where nesting occurred. Damage to trees was mainly caused by fecal deposits, and resulted in tree die off at breeding colonies and roost sites. Impacts to the herbaceous layer of vegetation were also reported due to fecal deposition, and often this layer was reduced or eliminated from the colony site. In addition, survey respondents reported that the impacts to avian species from cormorants occurred primarily from habitat degradation and from competition for nest sites (Wires et al. 2001). Although loss of vegetation can have an adverse effect on many species, some colonial waterbirds such as pelicans and terns prefer sparsely vegetated substrates.

As the population of double-crested cormorants has increased, so has concern for sport fishery populations (USFWS 2003). Cormorants can have a negative effect on recreational fishing on a localized level (USFWS 2003). Recreational fishing benefits local and regional economies in many areas of the United States, with some local economies relying heavily on income associated with recreational fisheries

(USFWS 2003). The collapse of sport fisheries can have negative economic impacts on businesses and can result in job losses (Shwiff and DeVault 2009).

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

The degree to which cormorant predation affects sport fishery populations in a given body of water is dependent on a number of variables, including the number of birds present, the time of year at which predation is occurring, prey species composition, and physical characteristics such as depth or proximity to shore (which affect prey accessibility). In addition to cormorant predation, environmental and human-induced factors affect aquatic ecosystems. Those factors can be classified as biological/biotic (*e.g.*, overexploitation, exotic species), chemical (*e.g.*, water quality, nutrient and contaminant loading), or physical/abiotic (*e.g.*, dredging, dam construction, hydropower operation, siltation). Such activities may lead to changes in species density, diversity, and/or composition due to direct effects on year class strength, recruitment, spawning success, spawning or nursery habitat, and/or competition (USFWS 1995).

Monk parakeet nests can damage wild trees in the same manner those nests may damage ornamental trees. When the nests become too heavy to support or become susceptibility to wind damage, broken branches or even toppling of trees may result.

Large accumulations of fecal droppings under crow roosts could be detrimental to desirable vegetation. A study conducted in Oklahoma found fewer annual and perennial plants in locations where crows roosted over several years (Hicks 1979). Large concentrations of waterfowl have affected water quality around beaches and in wetlands by acting as nonpoint source pollution. There are four forms of nonpoint source pollution: sedimentation, nutrients, toxic substances, and pathogens. Large concentrations of waterfowl can remove shoreline vegetation resulting in erosion of the shoreline and soil sediments being carried by rainwater into lakes, ponds, and reservoirs.

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

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 affect the productivity and survivorship of rare or endangered colonial species such as terns (United States Department of the Interior 1996), piping plovers, and American oystercatchers and prey upon the eggs

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

Crows are considered omnivorous, consuming a variety of invertebrates, amphibians, reptiles, mammals, and small birds, including birds' eggs, nestlings, and fledglings as well as grain crops, seeds, fruits, carrion, and discarded human food (Verbeek and Caffrey 2002). With crows, the primary concern to natural resources occurs from predation on T&E species. Crows have been documented feeding on piping plover (*Charadrius melodus*) eggs and nestlings. They have even been documented waiting on top of covered predator exclosures over piping plover nests, preying on chicks as they attempt to leave (M. Hake, National Park Service pers. comm. 2010). Piping plovers are currently considered a threatened species by the USFWS and by the RIDEM.

Other avian predators are known to prey on nesting piping plovers and terns. These include black-crowned night herons, common grackles, red-winged blackbirds, ruddy turnstones, great horned owls, peregrine falcons, Northern harriers and American kestrels are also known to feed on nesting colonial water birds and shorebirds, their chicks and/or eggs (Hunter and Morris 1976, Farraway et al. 1986, Rimmer and Deblinger 1990, Ivan and Murphy 2005, United States Army Corps of Engineers 2009). The WS program in Rhode Island has participated in interagency agreements to address black-crowned night heron and gull predation on common terns and federally and state endangered roseate terns inhabiting coastal islands of Rhode Island.

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

1.3 SCOPE OF THIS ENVIRONMENTAL ASSESSMENT

Actions Analyzed

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

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

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

The MBTA does allow for the lethal take of those bird species listed in 50 CFR 10.13 when depredation occurs through the issuance of depredation permits or the establishment of depredation orders. Under authorities in the MBTA, the USFWS is the federal agency responsible for the issuance of depredation permits or the establishment of depredation orders for the take of those protected bird species when

damage or threats of damage are occurring. Information regarding migratory bird permits can be found in 50 CFR 13 and 50 CFR 21.

Native American Lands and Tribes

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

Federal, State, Municipal, and Private Lands

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

Period for which this EA is Valid

If the analyses in this EA indicates an EIS is not warranted, this EA would remain valid until WS and the USFWS determines that new needs for action, changed conditions, new issues, or new alternatives having different environmental impacts must be analyzed. At that time, this analysis and document would be reviewed and supplemented pursuant to the NEPA. WS and the USFWS would conduct periodic reviews of the EA to ensure that activities conducted under the selected alternative occurred within the parameters evaluated in the EA. If the alternative analyzing no involvement in bird damage management activities by WS were selected, no additional analyses would occur based on the lack of involvement by WS. The monitoring of activities by WS and the USFWS would ensure the EA remained appropriate to the scope of activities conducted by WS and the USFWS under the selected alternative.

Site Specificity

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

This EA analyzes the potential impacts of bird damage management based on previous activities conducted on private and public lands in Rhode Island where WS and the appropriate entities have entered into a Memorandum of Understanding (MOU), cooperative service agreement, or other comparable document. This EA also addresses the potential impacts of activities in 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 efforts could occur. Thus, this EA anticipates those additional efforts and analyzes the impacts of such efforts as part of the alternatives.

Many of the bird species addressed in this EA can be found statewide and throughout the year; therefore, damage or threats of damage associated with those bird species could occur wherever those birds occur. Planning for the management of bird damage must be viewed as being conceptually similar to the actions of other entities whose missions are to stop or prevent adverse consequences from anticipated future events for which the actual sites and locations where they would occur are unknown but could be anywhere in a defined geographic area. Examples of such agencies and programs include fire departments, police departments, emergency clean-up organizations, and insurance companies. Some of the sites where bird damage could occur can be predicted; however, specific locations or times where such damage would occur in any given year cannot be predicted. The threshold triggering an entity to request assistance from WS and the USFWS to manage damage associated with birds is often unique to the individual; therefore, predicting where and when such a request for assistance would be received 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 the EA.

Chapter 2 of this EA identifies and discusses issues relating to bird damage management in Rhode Island. The standard WS Decision Model (Slate et al. 1992) would be the site-specific procedure for individual actions conducted by WS in the State (see Chapter 3 for a description of the Decision Model and its application). Decisions made using the model would be in accordance with WS' directives[10] 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 Rhode Island. In this way, WS and the USFWS believes it meets the intent of the NEPA with regard to site-specific analysis and that this is the only practical way for WS and the USFWS to comply with the NEPA and still be able to address damage and threats associated with birds.

Summary of Public Involvement

Issues related to bird damage management and the alternatives to address those issues were initially developed by WS and the USFWS, in consultation with the RIDEM. Issues were defined and preliminary alternatives were identified through the scoping process. As part of this process, and as required by the CEQ and APHIS' NEPA implementing regulations, this document will be noticed to the public for review and comment. This EA will be noticed to the public through legal notices published in local print media, through direct mailings to interested parties, and by posting the EA on the APHIS website at http://www.aphis.usda.gov/wildlife_damage/nepa.shtml.

WS and the USFWS will make the EA available for a minimum of 30 days for the public and interested parties to provide new issues, concerns, and/or alternatives. Through the public involvement process, WS, along with the USFWS, will clearly communicate to the public and interested parties the analyses of

[10] 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.

potential environmental impacts on the quality of the human environment. New issues or alternatives identified after publication of notices announcing the availability of the EA will be fully considered to determine whether the EA should be revisited and, if appropriate, revised prior to issuance of a final decision. New issues or alternatives identified from the public involvement process will be fully considered prior to reaching a decision on this EA.

1.4 RELATIONSHIP OF THIS DOCUMENT TO OTHER ENVIRONMENTAL DOCUMENTS

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

Extended Management of Double-crested Cormorants under 50 CFR 21.47 and 21.48 Final Environmental Assessment: The cormorant management FEIS developed by the USFWS in cooperation with WS established a Public Resource Depredation Order (PRDO; 50 CFR 21.48) and made changes to the 1998 Aquaculture Depredation Order (AQDO; 50 CFR 21.47). To allow for an adaptive evaluation of activities conducted under the PRDO and the AQDO established by the FEIS, those Orders would have expired on April 30, 2009 (USFWS 2003). The EA determined that a five-year extension of the expiration date of the PRDO and the AQDO would not threaten cormorant populations and activities conducted under those Orders would not have a significant impact on the human environment (74 FR 15394-15398; USFWS 2009).

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

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

Environmental Assessment-Reducing Gull Damage through an Integrated Wildlife Damage Management Program in the State of Rhode Island: WS has developed an EA that analyzes a need for action to manage damage associated with laughing, ring-billed, herring and great black-backed gull damage and threats in Rhode Island (USDA 2008). The EA identified issues associated with gull damage to property, agriculture, and natural resources, threats to aviation safety and human health and safety

related to gulls and analyzed alternatives to address those issues. After review of the analyses in the EA, a Decision and Finding of No Significant Impact (FONSI) were signed on July 9, 2008, selecting the proposed action to implement an integrated approach to managing damage and threats caused by gulls the State.

***Environmental Assessment-Reducing Canada Goose Damage throughout the State of Rhode Island*:** WS has developed an EA that analyzes a need for action to manage damage associated with Canada geese in Rhode Island (USDA 2010). The EA identified issues associated with goose damage management and analyzed alternatives to address those issues. After review of the analyses in the EA, a FONSI were signed on August 5, 2010, selecting the proposed action to implement an integrated approach to managing goose damage in the State.

Proposal to Permit Take as Provided under the Bald and Golden Eagle Protection Act Final Environmental Assessment: The EA developed by the USFWS evaluated the issues and alternatives associated with permitting 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 authorized disturbance of eagles, which constitutes "*take*" as defined under the Bald and Golden Eagle Protection Act, authorizes the removal of eagle nests where necessary to reduce threats to human safety, and evaluated the issuance of permits authorizing the lethal take of eagles in limited circumstances. A Decision and FONSI was made for the preferred alternative in the EA (USFWS 2010).

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

Atlantic Brant Management Plan 2002, Revised 2011: The purpose of the Atlantic Brant Management Plan is to provide management goals, objectives, and strategies for Atlantic brant conservation. The Action Plan outlines steps necessary for appropriate brant management. The Research Plan identifies information needed to improve the approaches outlined in the Action and Hunt Plans. The Hunt Plan identifies the management goal and objectives for brant harvest and contains strategies to attain them (Atlantic Flyway Council 2011).

1.5 AUTHORITY OF FEDERAL AND STATE AGENCIES

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

WS' Legislative Authority

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

United States Fish and Wildlife Service Authority

The USFWS mission is to conserve, protect, and enhance fish and wildlife, including 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 species that are listed as threatened or endangered under the ESA. The take of migratory birds is prohibited by the MBTA. However, the USFWS can issue depredation permits for the take of migratory birds when certain criteria are met pursuant to the MBTA. Depredation permits are issued to take migratory birds to alleviate damage and threats of damage. Under the permitting application process, the USFWS requires applicants to describe prior non-lethal damage management techniques that have been used. In addition, the USFWS can establish depredation orders that allow for the take of migratory birds. Under depredation orders, take can occur when those bird species are causing damage or when those species are about to cause damage without the need for a depredation permit.

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

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

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

United States Environmental Protection Agency (EPA)

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

United States Food and Drug Administration (FDA)

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

Rhode Island Department of Environmental Management Legislative Authority over Fisheries and Wildlife

The Director of the RIDEM is granted authority over fish and wildlife by the Rhode Island General Assemble under State of Rhode Island General Laws Title 20 Fish and Wildlife and exercises this authority through the Division of Fisheries and Wildlife. This authority along with the ability to create and enforce rules and regulations for managing fish and wildlife are granted under § 20-1-2, § 20-1-4 and § 20-1-5 as follows.

§ 20-1-2 Authority Over Fish and Wildlife – The general assembly hereby vests in the director of the department of environmental management authority and responsibility over the fish and wildlife of the state and over the fish, lobsters, shellfish, and other biological resources of marine waters of the state".

§ 20-1-4. Rules and regulations – The director is authorized to promulgate, adopt, and enforce any and all rules and regulations deemed necessary to carry out duties and responsibilities under this title.

§ 20-1-5 General enforcement powers – The director and the director's authorized agents, employees, and designees shall protect the wild birds, wild animals, fisheries, and shell fisheries throughout the state and shall administer and enforce the provisions of this title and the rules and regulations adopted pursuant to this title and shall prosecute violations of these laws and rules and regulations.

Rhode Island Department of Environmental Management Legislative Authority over Pesticides

The Director of the RIDEM is granted authority over pesticide regulation by the Rhode Island General Assemble under State of Rhode Island General Laws Title 23 Health and Safety and exercises this authority through the Division of Agriculture. This authority along with the ability to create and enforce rules and regulations for managing fish and wildlife are granted under § 23-25-2 and § 23-25-9 as follows.

§ 23-25-2. Enforcing Official – The provisions of this chapter shall be administered by the director of environmental management of the state, referred to as the director.

§ 23-25-9. Authority of Director, Determinations, Rules and Regulations, Restricted Use and Limited Use of Pesticides and Uniformity – (a) The director is authorized after due notice and an opportunity for a hearing:

(1) To declare as a pest any form of plant or animal life (other than humans and other than bacteria, viruses, and other micro-organisms on or in living humans or other living animals) which is injurious to health or the environment;

(2) To determine whether pesticides registered under the authority of § 24(c) of FIFRA, 7 U.S.C. § 136v(c), are highly toxic to humans. The definition of highly toxic, as defined in title 40, Code of Federal Regulations 162.8, as issued or amended, shall govern the director's determination; and

(3) To determine pesticides and quantities of substances contained in pesticides which are injurious to the environment. The director shall be guided by EPA regulations in this determination.

1.6 COMPLIANCE WITH LAWS AND STATUTES

Several laws or statutes authorize, regulate, or otherwise affect the activities of WS and the USFWS. WS and the USFWS would comply with those laws and statutes and consults with other agencies as appropriate. WS would comply with all applicable federal, State, and local laws and regulations in accordance with WS Directive 2.210. Those laws and regulations relevant to managing bird damage in the State are addressed below:

National Environmental Policy Act

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

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

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

The MBTA makes it unlawful to pursue, hunt, take, capture, kill, possess, import, export, transport, sell, purchase, barter, or offer for sale, purchase, or barter, any migratory bird, or their parts, nests, or eggs (16 USC 703-711). A list of bird species protected under the MBTA can be found in 50 CFR 10.13.
The MBTA also provides the USFWS regulatory authority to protect families of migratory birds. The law prohibits any "*take*" of migratory bird species by any entities, except as permitted by the USFWS. Under permitting guidelines in the Act, the USFWS may issue depredation permits to requesters experiencing damage caused by bird species protected under the Act. Information regarding migratory bird permits can be found in 50 CFR 13 and 50 CFR 21. European starlings, rock pigeons, house sparrows, monk parakeets, mute swans, and feral waterfowl are considered non-native species in the United States and are afforded no protection under the MBTA. A depredation permit from the USFWS is not required to take starlings, pigeons, house sparrows, monk parakeets, mute swans, and feral waterfowl. All actions conducted in this EA would comply with the regulations of the MBTA, as amended.

The law was further clarified to include only those birds afforded protection from take in the United States by the Migratory Bird Treaty Reform Act of 2004. Under the Reform Act, the USFWS published a list of bird species not protected under the MBTA (70 FR 12710-12716).

In addition to the issuance of depredation permits for the take of migratory birds, the Act allows for the establishment of depredation 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. Those bird species that could be lethally taken under the blackbird depredation order that are addressed in the assessment include American crows, fish crows, red-winged blackbirds, common grackles, and brown-headed cowbirds.

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

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

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

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

Control Order for Muscovy Ducks (50 CFR 21.54)

Muscovy ducks are native to South America, Central America, and Mexico with a small naturally occurring population in southern Texas. Muscovy ducks have also been domesticated and have been sold and kept for food and as pets in the United States. In many states, Muscovy ducks have been released or escaped captivity and have formed feral populations, especially in urban areas, that are non-migratory. The USFWS has issued a Final Rule on the status of the Muscovy duck in the United States (75 FR 9316-9322). Since naturally occurring populations of Muscovy ducks are known to inhabit parts of south Texas, the USFWS has included the Muscovy duck on the list of bird species afforded protection under the MBTA at 50 CFR 10.13 (75 FR 9316-9322). To address damage and threats of damage associated with Muscovy ducks, the USFWS has also established a control order for Muscovy ducks under 50 CFR 21.54 (75 FR 9316-9322). Under 50 CFR 21.54, Muscovy ducks, and their nests and eggs, may be

removed or destroyed without a depredation permit from the USFWS at any time in the United States, except in Hidalgo, Starr, and Zapata Counties in Texas (75 FR 9316-9322).

Bald and Golden Eagle Protection Act (16 USC 668)

Congress enacted the Bald Eagle Protection Act (16 USC 668) in 1940; thereby, making it a criminal offense for any person to "*take*" or possess any bald eagle or any part, egg, or nest. The Act contained several exceptions that permitted take under certain circumstances. The Secretary of the Interior could take and possess bald eagles for scientific or exhibition purposes of public museums, scientific societies, and zoological parks; possession of any bald eagle (or part, nest, or egg) taken prior to 1940 was not prohibited; and the terms of the Act did not apply to Alaska. Since its original enactment, the Act has been amended several times to increase protections for eagles and/or provide exemptions for specific types of activities. For example, the amendment in 1962 was designed to give greater protection to immature bald eagles, and to include golden eagles. The 1962 amendment also created two exceptions to the Act. Those exceptions allowed the taking and possession of eagles for religious purposes of Native American tribes and provided that the Secretary of the Interior, on request of the governor of any State, could authorize the taking of golden eagles to seasonally protect domesticated flocks and herds in that State.

While bald eagles were federally listed as a threatened species, the ESA was the primary regulation governing the management of bald eagles in the lower 48 states. Now that bald eagles have been removed from the federal list of T&E species, the Bald and Golden Eagle Protection Act is the primary regulation governing bald eagle management. 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 can "*molest"* or *"disturb"* eagles. For the purposes of the Act, under 40 CFR 22.3, the term "*disturb"* as it relates to take has been defined as "*to agitate or bother a bald……eagle to a degree that causes, or is likely to cause, based on the best scientific information available, 1) injury to an eagle, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior."*

Endangered Species Act

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

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

The NHPA and its implementing regulations (36 CFR 800) require federal agencies to initiate the Section 106 process if an agency determines that the agency's actions are undertakings as defined in Sec. 800.16(y) and, if so, whether it is a type of activity that has the potential to cause effects on historic properties. If the undertaking is a type of activity that does not have the potential to cause effects on historic properties, assuming such historic properties were present, the agency official has no further obligations under Section 106. None of the methods described in this EA that would be available for use under the alternatives cause major ground disturbance, any physical destruction or damage to property, any alterations of property, wildlife habitat, or landscapes, nor involves the sale, lease, or transfer of ownership of any property. In general, such methods also do not have the potential to introduce visual, atmospheric, or audible elements to areas in which they are used that could result in effects on the

character or use of historic properties. Therefore, the methods that could be used by WS under the alternatives are not generally the types of activities that would have the potential to affect historic properties. If an individual activity with the potential to affect historic resources were planned under an alternative selected because of a decision on this EA, the site-specific consultation as required by Section 106 of the NHPA would be conducted as necessary.

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

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

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

Environmental Justice in Minority and Low Income Populations - Executive Order 12898

Executive Order 12898 promotes the fair treatment of people of all races, income levels, and cultures with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Environmental justice is the pursuit of equal justice and protection under the law for all environmental statutes and regulations without discrimination based on race, ethnicity, or socioeconomic status. Executive Order 12898 requires federal agencies to make environmental justice part of their mission, and to identify and address disproportionately high and adverse human health and environmental effects of federal programs, policies, and activities on minority and low-income persons or populations. All activities are evaluated for their impact on the human environment and compliance with Executive Order 12898.

WS would only use legal, effective, and environmentally safe methods, tools, and approaches. Chemical methods employed by WS would be regulated by the EPA through FIFRA, the RIDEM, by MOUs with land managing agencies, and by WS' Directives. WS would properly disposes of any excess solid or hazardous waste. It is not anticipated that the alternatives would result in any adverse or disproportionate environmental impacts to minority and low-income persons or populations.

Protection of Children from Environmental Health and Safety Risks - Executive Order 13045

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

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

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

Invasive Species - Executive Order 13112

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

The Native American Graves and Repatriation Act of 1990

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

Occupational Safety and Health Act of 1970

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

Federal Insecticide, Fungicide, and Rodenticide Act

The FIFRA requires the registration, classification, and regulation of all pesticides used in the United States. The EPA is responsible for implementing and enforcing the FIFRA. All pesticides employed and/or recommended by the WS' program in Rhode Island pursuant to the alternatives would be registered with the EPA and registered for use in the State by the RIDEM, when applicable. All

pesticides 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.

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

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

Animal Medicinal Drug Use Clarification Act of 1994

The Animal Medicinal Drug Use Clarification Act (AMDUCA) and its implementing regulations (21 CFR 530) establish several requirements for the use of animal drugs, including those used to capture and handle wildlife in damage management programs. Those requirements are: (1) a valid "*veterinarian-client-patient*" relationship, (2) well defined record keeping, (3) a withdrawal period for animals that have been administered drugs, and (4) identification of animals. A veterinarian, either on staff or on an advisory basis, would be involved in the oversight of the use of animal capture and handling drugs under any alternative where WS could use those immobilizing and euthanasia drugs. Veterinary authorities in each state have the discretion under this law to establish withdrawal times (*i.e.*, an amount of time after a drug is administered that must lapse before an animal may be used for food) for specific drugs. Animals that might be consumed by a human within the withdrawal period must be identified. WS establishes procedures in each state for administering drugs used in wildlife capture and handling that must be approved by state veterinary authorities in order to comply with this law.

Investigational New Animal Drug (INAD)

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

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

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

Memorandum of Understanding between the RIDEM and WS

A MOU between the RIDEM, RI Department of Public Health, University of Rhode Island Cooperative Extension Service, Rhode Island Airport Corporation, and WS was developed in 2002. The purpose was to establish a cooperative relationship between RI State Agencies and WS for planning, coordinating and implementing policies to prevent or minimize damage caused by wildlife to agriculture, property, and natural resources and to safeguard public health and safety; to facilitate an exchange of information; to encourage research on wildlife damage management; and to provide a basis for the establishment of cooperative agreements to conduct wildlife damage management activities.

State of Rhode Island General Laws Title 20 - Fish and Wildlife

§ 20-1.4: Rules and regulations – The director is authorized to promulgate, adopt, and enforce any and all rules and regulations deemed necessary to carry out duties and responsibilities under this title.

§ 20-1.12: Fixing of seasons and bag limits – (a) The director is authorized to adopt regulations fixing seasons, bag limits, size limits, possession limits, and methods of taking on any species of fish, game, bird, or other wild animal occurring within the state, other than marine species regulated by the marine fisheries council.

(1) These regulations may prohibit the taking, holding, or possession of any species, prohibit the taking, molestation, or disturbance in any way of nesting, breeding, or feeding sites of any species and/or prohibit, control, or regulate any commercial use, importation into the state, or exportation from the state of any species.

(2) These regulations may be of statewide applicability or may be applicable in any specified locality or localities within the state when the director shall find, after investigation, that the regulations are appropriate.

(b) Any person who violates any provision of this section or any rule or regulation made under the provisions of this section shall be guilty of a civil violation and subject to a fine of one hundred dollars ($100) for each offense.

(c) Notwithstanding any inconsistent provision of law, the traffic tribunal shall have jurisdiction to hear and determine all violations specified in this section.

(d) The regulations shall be adopted only after the holding of a public hearing subject to the provisions of the Administrative Procedures Act, chapter 35 of title 42.

§ 20-1.13: Publication and effective date of seasons and bag limits – Notice of the director's intention to adopt regulations pursuant to § 20-1-12 and the holding of a public hearing on these regulations shall be published in at least one newspaper of general statewide circulation, not less than twenty (20) days prior to the date of the public hearing. These regulations shall remain in effect not longer than one year following the date of their effectiveness.

State of Rhode Island General Laws Title 42 - State Affairs and Government

§ 42-17.1: Department of Environmental Management
§ 42-17.1-1 Department established – There is hereby established within the executive branch of the state government a department of environmental management. The head of the department shall be the director of environmental management, who shall be in the unclassified service and who shall be appointed by the governor, with the advice and consent of the senate, and shall serve at the pleasure of the governor.

§ 42-17.6: Administrative Penalties for Environmental Violations
§ 42-17.6-2 Authority of director to assess penalty – The director may assess an administrative penalty on a person who fails to comply with any provision of any rule, regulation, order, permit, license, or approval issued or adopted by the director, or of any law which the director has the authority or responsibility to enforce. Any such penalty shall be an alternative to any other civil penalty that may be prescribed by law.

§ 42-35: Administrative Procedures
§ 42-35-1.1 Bodies subject to chapter – Notwithstanding any other provision of the general laws or any public law or special act to the contrary, all agencies as defined in § 42-35-1(a) and all agencies, boards, commissions, departments, and officers authorized by law to make rules or to determine contested cases, and all authorities as defined in § 42-35-1(b) are subject to

1.7 DECISIONS TO BE MADE

Management of migratory birds is the responsibility of the USFWS. As the authority for the overall management of bird populations, the USFWS was involved in the development of the EA and provided input throughout the EA preparation process to ensure an interdisciplinary approach according to the NEPA and agency mandates, policies, and regulations. The RIDEM is responsible for managing wildlife in the State of Rhode Island, including birds. The RIDEM establishes and enforces regulated hunting seasons in the State, including the establishment of hunting seasons that allow the harvest of some of the bird species addressed in this assessment. For migratory birds, the RIDEM can establish hunting seasons for those species under frameworks determined by the USFWS. WS' activities to reduce and/or prevent bird damage in the State would be coordinated with the USFWS and the RIDEM, which would ensure WS' actions were incorporated into population objectives established by those agencies for bird populations in the State. The take of many of the bird species addressed in this EA can only occur when authorized by a depredation permit issued by the USFWS and the RIDEM; therefore, the take of those bird species to alleviate damage or reduce threats of damage would only occur at the discretion of those agencies.

Based on the scope of this EA, the decisions to be made are: 1) should WS conduct bird damage management to alleviate damage to agriculture, property, natural resources, and threats to human safety, 2) should the Migratory Bird Program in USFWS Region 5 issue depredation permits to WS and other entities to conduct bird damage management activities when requested, 3) should WS conduct disease surveillance and monitoring in the bird population when requested by the RIDEM, the USFWS, and other agencies, 4) should WS implement an integrated damage management strategy, including technical assistance and direct operational assistance, to meet the need for bird damage management, 5) if not, should WS attempt to implement one of the other alternatives described in the EA, and 6) would the alternatives result in effects to the human environment requiring the preparation of an EIS.

CHAPTER 2: AFFECTED ENVIRONMENT AND ISSUES

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

2.1 AFFECTED ENVIRONMENT

Damage or threats of damage caused by those bird species addressed in this EA can occur statewide in Rhode Island wherever those species of birds occur. However, assistance would only be provided by WS when requested by a landowner or manager and only on properties where a cooperative service agreement or other comparable document had been signed between WS and the cooperating entity. Most species of birds addressed in this EA can be found throughout the year across the State where suitable habitat exists for foraging, loafing, roosting, and breeding. Those bird species addressed in this EA are capable of utilizing a variety of habitats in the State. Since birds can be found throughout the State, requests for

assistance to manage damage or threats of damage could occur in areas occupied by those bird species. Additional information on the affected environment is provided in Chapter 4.

Upon receiving a request for assistance, the proposed action alternative or those actions described in the other alternatives could be conducted on private, federal, State, tribal, and municipal lands in Rhode Island 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 Rhode Island that are currently being conducted under a MOU or cooperative service agreement with WS where activities have been and currently are being conducted. This EA also addresses the potential impacts of bird damage management in the State where additional agreements may be signed in the future. The USFWS would only issue a depredation permits for the take of birds when requested; therefore, this EA evaluates information from depredation permits issued previously by the USFWS to alleviate damage.

Upon receipt of a request for assistance, bird damage management activities under the alternatives, where permitted, could be conducted on federal, State, tribal, municipal, and private properties in Rhode Island. The affected environment could include areas in and around commercial, industrial, public, and private buildings, facilities and properties and at other sites where birds may roost, loaf, feed, nest, or otherwise occur. Examples of areas where bird damage management activities could be conducted are: 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, 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 from a non-federal entity conducting the action in the absence of the federal action. This concept is applicable to situations involving federal assistance in managing damage associated with resident wildlife species managed by the state natural resources agency, invasive species, or unprotected wildlife species.

Most bird species are protected under state or federal law and to address damage associated with those species, a permit must be obtained from the appropriate federal and/or state agency. However, in some situations, with the possible exception of restrictions on methods (*e.g.*, firearms restrictions, pesticide regulations), some species can be managed without the need for a permit when they are causing damage (*e.g.*, take under depredation orders, unprotected bird species). For some bird species, take during the hunting season is regulated pursuant to the MBTA by the USFWS through the issuance of frameworks, that includes the allowable length of hunting seasons, methods of harvest, and daily harvest limits, which are implemented by the RIDEM. Under the blackbird depredation order (see 50 CFR 21.43), blackbirds can be addressed by any entity without the need for a depredation permit when those species identified in

the Order are found committing damage, when about to commit damage, or when posing a human safety threat. In addition, Muscovy ducks can also be removed without the need for a depredation permit in Rhode Island under the control order issued by the USFWS. Pursuant to the MBTA, the USFWS can issue depredation permits to those entities experiencing damage associated with birds, when deemed appropriate.

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

When a non-federal entity (*e.g.*, agricultural producers, health agencies, municipalities, counties, private companies, individuals, or any other non-federal entity) takes an action involving a bird species, the action is not subject to compliance with the NEPA due to the lack of federal involvement[11] 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 should be used, WS' involvement in the action would not affect the environmental status quo since the entity could take the action in the absence of WS' involvement. Since take could occur during hunting seasons, under depredation orders, through the issuance of depredation permits, or for some species take can occur at any time without the need for a depredation permit, an entity could take an action in the absence of WS' involvement. WS' involvement would not change the environmental status quo if the requestor had conducted the action in the absence of WS' involvement in the action.

In addition, most methods for resolving damage are available to WS and to other entities. Therefore, WS' decision-making ability would be restricted to one of three alternatives. Under those three alternatives, WS could provide technical assistance with managing damage with no direct involvement, take the action using the specific methods as decided upon by the non-federal entity, or take no action. If no action was taken by WS, the non-federal entity could take the action anyway either without a permit, during the hunting season, under depredation orders, under a control order, or through the issuance of a depredation permit by the USFWS and the RIDEM. Under those circumstances, WS would have virtually no ability to affect the environmental status quo since the action would likely occur in the absence of WS' direct involvement.

Therefore, based on the discussion above, in those situations where a non-federal entity has already made the decision to remove or otherwise manage birds to stop damage with or without WS' assistance, WS' participation in carrying out that action would not affect the environmental status quo.

Airports

Because many bird species are ubiquitous throughout the State, it is possible for those species to be present at nearly any airport or military airbase. WS may be requested to address threats of aircraft

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

strikes from airport authorities at any of the airports or airbases in the State where those bird species addressed in this assessment pose a threat to aircraft and passenger safety.

Federal Property

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

State Property

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

Municipal Property

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

Private Property

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

Disease Surveillance and Monitoring Activities

Upon receiving a request for assistance, activities under the appropriate alternatives could be conducted on private, federal, state, county, and municipal lands in the State for the purposes of studying, containing, and curtailing disease outbreaks in bird populations. Areas of the proposed action could include, but are not limited to, state, county, municipal and federal natural resource areas, park lands, and historic sites; state and interstate highways and roads; railroads and their rights-of-way; airports and military airbases, property in or adjacent to subdivisions, businesses, and industrial parks; timberlands, croplands, and pastures; public and private properties in rural/urban/suburban areas where birds are a threat to human safety through vehicle collisions and the spread of disease.

2.2 ISSUES ASSOCIATED WITH BIRD DAMAGE MANAGEMENT ACTIVITIES

Issues are concerns of the public and/or professional community raised regarding potential adverse effects that might occur from a proposed action. Such issues must be considered in the NEPA decision-making process. Those issues identified in the cormorant management FEIS developed by the USFWS, in cooperation with WS, were considered during the development of this EA. Issues related to managing damage associated with birds in Rhode Island were developed by WS in cooperation with the USFWS, and in consultation with the RIDEM. This EA will also be made available to the public for review and comment to identify additional issues.

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

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

A common issue when addressing damage caused by wildlife are the potential impacts of management actions on the populations of target species. Methods available to alleviate damage or threats to human safety are categorized into non-lethal and lethal methods. Non-lethal methods available can disperse or otherwise make an area unattractive to target species causing damage, which reduces the presence of those species at the site and potentially the immediate area around the site where non-lethal methods were employed. Lethal methods would also be available to remove a bird or those birds responsible for causing damage or posing threats to human safety. Therefore, if lethal methods were used, the removal of a bird or birds 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.

The analysis for magnitude of impact on the populations of those species addressed in this EA from the use of lethal methods would be based on a measure of the number of individuals lethally removed in relation to 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 of birds lethally removed with overall populations or trends. Lethal methods would only be used by WS at the requests of a cooperator seeking assistance and only after the take of those birds species had been permitted by the USFWS pursuant to the MBTA and the RIDEM, when required.

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

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

Breeding Bird Survey

Bird populations can be monitored by using trend data derived from data collected during the BBS. Under established guidelines, observers count birds at established survey points along roadways for a set duration along a pre-determined route, usually along a road. Routes are 24.5 miles long and are surveyed once per year with the observer stopping every 0.5 miles along the route to conduct the survey. The numbers of birds observed and heard within 0.25 miles of each of the survey points are recorded during a 3-minute sampling period at each point. Surveys were started in 1966 and are conducted in June, which is generally considered as the period of time when those birds present at a location are likely breeding in the immediate area. The BBS is conducted annually in the United States, across a large geographical area, under standardized survey guidelines. The BBS is a large-scale inventory of North American birds coordinated by the United States Geological Survey, Patuxent Wildlife Research Center (Sauer et al. 2012). The BBS is a combined set of over 3,700 roadside survey routes primarily covering the continental United States and southern Canada. The primary objective of the BBS has been to generate an estimate of population change for all breeding birds. Populations of birds tend to fluctuate, especially locally, because of variable local habitat and climatic conditions. Trends can be determined using different population equations and statistically tested to determine if a trend is statistically significant.

Current estimates of population trends from BBS data are derived from hierarchical model analysis (Link and Sauer 2002, Sauer and Link 2011) and are dependent upon a variety of assumptions (Link and Sauer 1998). The statistical significance of a trend for a given species is also determined using BBS data (Sauer et al. 2012).

Christmas Bird Count

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

Partners in Flight Landbird Population Estimate

The BBS data are intended for use in monitoring bird population trends, but it is also possible to use BBS data to develop a general estimate of the size of bird populations. Using relative abundances derived from the BBS in the 1990s, Rich et al. (2004) extrapolated population estimates for many bird species in North America as part of the Partners in Flight Landbird Population Estimate database. The Partners in Flight system involves extrapolating the number of birds in the 50 quarter-mile circles (total area/route = 10 mi^2) surveyed during the BBS to an area of interest. The model used by Rich et al. (2004) makes assumptions on the detectability of birds, which can vary for each species. Some species of birds that are more conspicuous (visual and auditory) are more likely to be detected during bird surveys when compared to bird species that are more secretive and do not vocalize often. Information on the detectability of a species is combined to create a detectability factor, which may be combined with relative abundance data from the BBS to yield a population estimate (Rich et al. 2004).

Annual Harvest Estimate

The populations of migratory bird species that are hunted are sufficient to allow for annual harvest seasons that typically occur during the fall migration periods of those species. Migratory bird hunting

seasons are established under frameworks developed by the USFWS and implemented in the State by the RIDEM. Those species addressed in this EA that have established hunting seasons include snow geese, brant, wood ducks, gadwalls, American wigeons, American black ducks, mallards, blue-winged teals, Northern shovelers, Northern pintails, American green-winged teals, canvasbacks, redheads, ring-necked ducks, greater scaup, lesser scaup, common eiders, surf scoters, white-winged scoters, black scoters, long-tailed ducks, buffleheads, common goldeneyes, hooded mergansers, common mergansers, red-breasted mergansers, ruddy ducks, Northern bobwhite, ring-necked pheasants, ruffed grouse, wild turkeys, Wilson's snipe, American woodcocks, mourning doves, American crows, fish crows, and American coot.

For crows, take can also occur under the blackbird depredation order established by the USFWS. 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 RIDEM in published reports.

Bird Conservation Regions

Bird Conservation Regions are areas in North America that are characterized by distinct ecological habitats that have similar bird communities and resource management issues. The State of Rhode Island lies within the New England/Mid-Atlantic Coast (Bird Conservation Region 30) region. The New England/Mid-Atlantic Coast region encompasses the coastal areas of States ranging from southern Maine to Virginia. Of all the Bird Conservation Regions in the United States, the New England/Mid-Atlantic Coast region has the highest human population densities. Much of the region was converted to agricultural production as human settlements expanded in the region, but today is dominated by forest and residential use (USFWS 2000).

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

Atlantic Flyway Breeding Waterfowl Plot Survey

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

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

The effects on non-target and T&E species arises from the use of non-lethal and lethal methods identified in the alternatives. The use of non-lethal and lethal methods has the potential to inadvertently disperse,

capture, or kill non-target wildlife. To reduce the risks of adverse effects to non-target wildlife, WS would select damage management methods that are as target-selective as possible or apply such methods in ways to reduce the likelihood of capturing non-target species. Before initiating management activities, WS would select locations that were extensively used by the target species. WS would also use SOPs designed to reduce the effects on non-target species' populations. SOPs are further discussed in Chapter 3. Methods available for use under the alternatives are described in Appendix B.

Concerns have also been raised about the potential for adverse effects to occur to non-target wildlife from the use of chemical methods. Chemical methods that would be available to manage damage or threats of damage associated with birds include the avicide DRC-1339, Avitrol, alpha chloralose, mesurol, nicarbazin, and taste repellents. Chemical methods that could be available for use to manage damage and threats associated with birds in Rhode Island are further discussed in Appendix B.

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

Special efforts are made to avoid jeopardizing T&E species through biological evaluations of the potential effects and the establishment of special restrictions or minimization measures. As part of the scoping process to facilitate interagency cooperation, WS consulted with the USFWS pursuant to Section 7 of the ESA during the development of this EA, which is further discussed in Chapter 4.

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

An additional issue often raised is the potential risks associated with employing methods to manage damage caused by target species. Both chemical and non-chemical methods have the potential to have adverse effects on human safety. WS' employees would use and recommend only those methods that were legally available, selective for target species, and were effective at resolving the damage associated with the target species. Still, some concerns exist regarding the safety of WS' methods despite their legality. As a result, WS will analyze the potential for proposed methods to pose a risk to members of the public and employees of WS. In addition to the potential risks to the public associated with WS' methods, risks to employees would also be an issue. WS' employees could potentially be exposed to damage management methods as well as subject to workplace accidents. Selection of methods would include consideration for public and employee safety.

Safety of Chemical Methods Employed

The issue of using chemical methods as part of managing damage associated with wildlife relates to the potential for human exposure either through direct contact with the chemical or exposure to the chemical from wildlife that have been exposed. Under the alternatives identified, the use of chemical methods would include avicides, alpha chloralose, reproductive inhibitors, and repellents. Avicides are those chemical methods used to remove birds lethally. DRC-1339 is the only avicide currently being considered for use to manage damage in this assessment. DRC-1339 is currently registered with the EPA for use by WS to manage damage associated with pigeons, starlings, red-winged blackbirds, brown-headed cowbirds, common grackles, crows, and gulls. However, none of the formulations registered with the EPA were also registered with the RIDEM for use in the State during the development of this document.

Several avian repellents are commercially available to disperse birds from an area or discourage birds from feeding on desired resources. Avitrol is flock dispersal methods available for use to manage damage associated with some bird species. For those species addressed in this assessment, Avitrol is available to manage damage associated with red-winged blackbirds, common grackles, brown-headed cowbirds, European starlings, house sparrows, rock pigeons, and crows. Other repellents are also available with the most common ingredients being polybutene, anthraquinone, and methyl anthranilate. In addition, Avitrol is registered as a flock-dispersing agent registered for house sparrows, crows, cowbirds, grackles, red-winged blackbirds, gulls, and pigeons. An additional repellent being considered for use in this assessment is mesurol, which is intended for use to discourage crows from predating on eggs of T&E species.

Alpha chloralose is also being considered as a method that could be employed under the alternatives to manage damage associated with waterfowl. Alpha chloralose could be used to sedate waterfowl temporarily and lessen stress on the animal from handling and transportation from the capture site. Drugs delivered to immobilize waterfowl would occur on site with close monitoring to ensure proper care of the animal. Alpha chloralose is reversible with a full recovery of sedated animals occurring. Reproductive inhibitors containing the active ingredient nicarbazin could also be available under the alternatives. Nicarbazin is the only reproductive inhibitor currently registered with the EPA for use to manage local populations of pigeons and waterfowl by reducing or eliminating the hatchability of eggs laid. The use of chemical methods would be regulated by the EPA through the FIFRA, by the FDA, the RIDEM, and by WS Directives[12]. Chemical methods are further discussed in Appendix B of this EA.

Safety of Non-Chemical Methods Employed

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

Many of the non-chemical methods available would only be activated when triggered by attending personnel (*e.g.*, cannon nets, firearms, pyrotechnics, lasers), are passive live-capture methods (*e.g.*, walk-in style live-traps, mist nets), or are passive harassment methods (*e.g.*, effigies, exclusion techniques, anti-perching devices, electronic distress calls). The primary safety risk of most non-chemical methods occurs directly to the applicator or those people assisting the applicator. However, risks to others do exist when employing non-chemical methods, such as when using firearms, cannon nets, or pyrotechnics. Most of the non-chemical methods available to address bird damage in Rhode Island would be available for use under any of the alternatives and could be employed by any entity, when permitted. Risks to human

[12]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.

safety from the use of non-chemical methods will be further evaluated as this issue relates to the alternatives in Chapter 4.

Effects of Not Employing Methods to Reduce Threats to Human Safety

An issue identified is the concern for human safety from not employing methods or not employing the most effective methods to reduce the threats that birds can pose. The risks to human safety from diseases associated with certain bird populations were addressed previously in Chapter 1 under the need for action section. The low risk of disease transmission from birds does not lessen the concerns of cooperators requesting assistance to reduce threats from zoonotic diseases. Increased public awareness of zoonotic events has only heightened the concern of direct or indirect exposure to zoonoses. Not adequately addressing the threats associated with potential zoonoses could lead to an increase in incidences of injury, illness, or loss of human life.

Additional concern is raised with inadequately addressing threats to human safety associated with aircraft striking birds at airports in the State. Birds have the potential to cause severe damage to aircraft and can threaten the safety of flight crews and passengers. If the use of certain methods to address the threat of aircraft striking birds was limited or were excluded from use, the unavailability of those methods could lead to higher risks to passenger safety. This issue will be fully evaluated in Chapter 4 in relationship to the alternatives.

Issue 4 - Effects on the Aesthetic Values of Birds

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

The human attraction to animals has been well documented throughout history and started when humans began domesticating animals. The American public shares a similar bond with animals and/or wildlife in general and in modern societies, high 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 can be derived from a personal relationship with animals, which may take the form of direct consumptive use (*e.g.*, using parts of or the entire animal) or non-consumptive use (*e.g.*, viewing the animal in nature) (Decker and Goff 1987).

Indirect benefits or indirect exercised values arise without the user being in direct contact with the animal and come from experiences such as looking at photographs and films of wildlife, reading about wildlife, or benefiting from activities or contributions of animals such as their use in research (Decker and Goff

1987). Indirect benefits come in two forms: bequest and pure existence (Decker and Goff 1987). Bequest is providing for future generations and pure existence is merely knowledge that the animals exist (Decker and Goff 1987).

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

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

Issue 5 - Humaneness and Animal Welfare Concerns of Methods

The issue of humaneness and animal welfare, as it relates to the killing or capturing of wildlife is an important but very complex concept that can be interpreted in a variety of ways. Schmidt (1989) indicated that vertebrate damage management for societal benefits could be compatible with animal welfare concerns, if *"…the reduction of pain, suffering, and unnecessary death is incorporated in the decision making process."*

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

Defining pain as a component in humaneness appears to be a greater challenge than that of suffering. Pain obviously occurs in animals. Altered physiology and behavior can be indicators of pain and identifying the causes that elicit pain responses in humans would "*…probably be causes for pain in other animals…*" (AVMA 1987). However, pain experienced by individual animals probably ranges from little or no pain to considerable pain (California Department of Fish and Game 1991).

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

Pain and suffering, as it relates to methods available for use to manage birds has both a professional and lay point of arbitration. Wildlife managers and the public would be better served to recognize the complexity of defining suffering, since *"…neither medical nor veterinary curricula explicitly address*

suffering or its relief" (California Department of Fish and Game 1991). Research suggests that some methods can cause "*stress*" (Kreeger et al. 1988). However, such research has not yet progressed to the development of objective, quantitative measurements of pain or stress for use in evaluating humaneness (Bateson 1991).

The decision-making process involves trade-offs between the above aspects of pain and humaneness. Therefore, humaneness, in part, appears to be a person's perception of harm or pain inflicted on an animal, and people may perceive the humaneness of an action differently. The challenge in coping with this issue is how to achieve the least amount of animal suffering. The issue of humanness and animal welfare concerns, as those concerns relate to the methods available, will be further discussed for use under the alternatives in Chapter 4. SOPs to alleviate pain and suffering are discussed in Chapter 3.

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

Another issue commonly identified is a concern that damage management activities conducted by WS would affect the ability of persons to harvest those species during the regulated hunting seasons either by reducing local populations through the lethal removal of birds or by reducing the number of birds present in an area through dispersal techniques. Those species that are addressed in this EA that also can be hunted during regulated seasons in the State include American crows, fish crows, wild turkeys, ring-necked pheasants, ruffed grouse, Northern bobwhites, mourning doves, snow geese, brant, wood ducks, gadwalls, American wigeons, American black ducks, mallards, blue-winged teal, Northern shovelers, Northern pintails, green-winged teal, canvasbacks, redheads, ring-necked ducks, greater scaup, lesser scaup, common eiders, surf scoters, white-winged scoters, black scoters, long-tailed ducks, buffleheads, common goldeneyes, hooded mergansers, common mergansers, red-breasted mergansers, ruddy ducks, Wilson's snipe, American woodcocks, and American coots.

Potential impacts could arise from the use of non-lethal or lethal damage management methods. Non-lethal methods used to reduce or alleviate damage caused by those birds species are used to reduce bird densities through dispersal in areas where damage or the threat of damage is occurring. Similarly, lethal methods used to reduce damage associated with those birds could lower densities in areas where damage is occurring resulting in a reduction in the availability of those species during the regulated harvest season. WS' bird damage management activities would primarily be conducted on populations in areas where hunting access is restricted (*e.g.*, airports, urban areas) or has been ineffective. The use of non-lethal or lethal methods often disperses birds from areas where damage is occurring to areas outside the damage area, which could serve to move those bird species from those less accessible areas to places accessible to hunters.

Issue 7 - Effectiveness of Bird Damage Management Methods

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

The purpose behind integrated management is to implement methods in the most effective manner while minimizing the potentially harmful effects on humans, target and non-target species, and the environment[13]. Efficacy is based on the types of methods employed, the application of the method, restrictions on the use of the method(s), the skill of the personnel using the method and, for WS' personnel, the guidance provided by WS' directives and policies.

The goal would be to reduce damage, risks, and conflicts with birds as requested and not to necessarily reduce/eliminate populations. Localized population reduction could be short-term since new individuals may immigrate to an area, be released at the site, or new individuals could be born to animals remaining at the site (Courchamp et al. 2003). The ability of an animal population to sustain a certain level of removal and to return to pre-management population levels eventually does not mean individual management actions are unsuccessful, but that periodic management may be necessary. The return of wildlife to pre-management levels also demonstrates that limited, localized damage management methods have minimal impacts on species' populations.

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

2.3 ISSUES CONSIDERED BUT NOT IN DETAIL WITH RATIONALE

Additional issues were identified by WS, the RIDEM, and the USFWS during the scoping process of this EA. The following issues were considered; however, those issues will not receive detailed analyses for the reasons provided.

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

A concern was raised that an EA for an area as large as the State of Rhode Island would not meet the NEPA requirements for site specificity. Wildlife damage management falls within the category of federal or other regulatory agency actions in which the exact timing or location of individual activities cannot usually be predicted well enough ahead of time to describe accurately such locations or times in an EA or an EIS. Although WS can predict some of the possible locations or types of situations and sites where some kinds of wildlife damage 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 the destruction of wild animal populations over broad areas at a much more intensive level than would be desired by most people, including WS and other agencies. Such broad scale population management would also be impractical or impossible to achieve within WS' policies and professional philosophies.

Lead agencies have the discretion to determine the geographic scope of their analyses under the NEPA (Kleppe v Sierra Club, 427 U.S. 390, 414 (1976), CEQ 1508.25). Ordinarily, according to APHIS 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

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

action could potentially have significant individual and/or cumulative impacts on the quality of the human environment that would warrant the preparation of an EIS or a FONSI. This EA addresses impacts for managing damage and threats to human safety associated with birds in the State to analyze individual and cumulative impacts and to provide a thorough analysis.

In terms of considering cumulative effects, one EA analyzing impacts for the entire State would provide a more comprehensive and less redundant analysis than multiple EAs covering smaller areas. If a determination were made through this EA that the proposed action or the other alternatives could potentially 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 Rhode Island would continue to conduct bird damage management in a very small area of the State where damage is occurring or likely to occur.

WS' Impact on Biodiversity

The WS program does not attempt to eradicate any species of native wildlife in the State. WS operates in accordance with applicable federal and state laws and regulations enacted to ensure species viability. Methods available are employed to target individual birds or groups of birds identified as causing damage or posing a threat of damage. Any reduction of a local population or group would frequently be temporary because immigration from adjacent areas or reproduction would replace the animals removed. WS operates on a small percentage of the land area in Rhode Island and would only target those birds identified as causing damage or posing a threat. Therefore, activities that could be conducted under the alternatives would not adversely affect biodiversity in the State.

A Loss Threshold Should Be Established Before Allowing Lethal Methods

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

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

Bird Damage Management Should Not Occur at Taxpayer Expense

An issue identified is the concern that wildlife damage management should not be provided at the expense of the taxpayer or that activities should be fee-based. Funding for activities could be derived from federal appropriations and through cooperative funding. Activities conducted in the State for the management of damage and threats to human safety from birds would be funded through cooperative service agreements with individual property owners or managers. A minimal federal appropriation is allotted for the maintenance of a WS program in Rhode Island. The remainder of the WS program would be entirely fee-based. Technical assistance would be provided to requesters as part of the federally funded activities, but

all direct assistance in which WS' employees perform damage management activities would be funded through cooperative service agreements between the requester and WS. Therefore, in most cases, the entity requesting assistance would be providing the funding for activities conducted by WS.

Cost Effectiveness of Management Methods

The CEQ does not require a formal, monetized cost benefit analysis to comply with the NEPA. Consideration of this issue would not be essential to making a reasoned choice among the alternatives being considered. However, the methods determined to be most effective at reducing damage and threats to human safety caused by birds and that prove to be the most cost effective would receive the greatest application. As part of an integrated approach, evaluation of methods would continually occur to allow for those methods that were most effective at resolving damage or threats to be employed under similar circumstances where birds were causing damage or 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. The issue of cost effectiveness as it relates to the effectiveness of methods is discussed further in Section 2.2 of this EA.

Impacts of Avian Influenza (AI) on Bird Populations

AI is caused by a virus in the Orthomyxovirus group. Viruses in this group vary in the intensity of illness (*i.e*., virulence) they may cause. Wild birds, in particular waterfowl and shorebirds, are considered the natural reservoirs for AI (Clark and Hall 2006). Most strains of AI rarely cause severe illness or death in birds although the H5 and H7 strains tend to be highly virulent and very contagious. However, even the strains that do not cause severe illness in birds are a concern for human and animal health officials because the viruses have the potential to become virulent and transmissible to other species through mutation and re-assortment (Clark and Hall 2006).

Recently, the occurrence of highly pathogenic (HP) H5N1 AI virus has raised concern regarding the potential impact on wild birds, domestic poultry, and human health should it be introduced into the United States. It is thought that a change occurred in a low pathogenicity AI virus of wild birds, allowing the virus to infect chickens, followed by further change into the HP H5N1 AI. HP H5N1 AI has been circulating in Asian poultry and fowl resulting in death to those species. HP H5N1 AI likely underwent further change allowing infection in additional species of birds, mammals, and humans. More recently, this virus moved back into wild birds resulting in mortality of some species of waterfowl, and other birds. This is only the second time in history that the HP form of AI has been recorded in wild birds. Numerous potential routes for introduction of the virus into the United States exist including the illegal movement of domestic or wild birds, contaminated products, infected travelers, and the migration of infected wild birds. WS has been one of several agencies and organizations conducting surveillance for AI virus in migrating birds. The nationwide surveillance effort has detected some instances of low pathogenic AI viruses, as was expected given that waterfowl and shorebirds are considered the natural reservoirs for AI. Tens of thousands of birds have been tested, but there has been no evidence of the HP H5N1 virus in North America. Currently, there is no evidence to suggest AI has negatively affected bird populations in North America. As stated previously, most strains of AI do not cause severe illnesses or death in bird populations.

Bird Damage Should Be Managed By Private Nuisance Wildlife Control Agents

Wildlife control agents and private entities could be contacted to reduce bird damage when deemed appropriate by the resource owner. The RIDEM maintains a website with contact information for

licensed Nuisance Wildlife Control Specialists in the State[14]. In addition, WS could refer persons requesting assistance to other entities under all of the alternatives fully evaluated in the EA.

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

Effects from the Use of Lead Ammunition in Firearms

Questions have arisen about the deposition of lead into the environment from ammunition used in firearms to remove birds lethally. As described in Appendix B, the lethal removal of birds with firearms by WS to alleviate damage or threats could occur using a rifle or shotgun. In an ecological risk assessment of lead shot exposure in non-waterfowl birds, ingestion of lead shot was identified as the concern rather than just contact with lead shot or lead leaching from shot in the environment (Kendall et al. 1996). To address lead exposure from the use of shotguns, the USFWS Migratory Bird Permit Program has implemented the requirement to use non-toxic shot as defined under 50 CFR 20.21(j) as part of the standard conditions of depredation permits issued pursuant to the MBTA for the lethal take of birds under 50 CFR 21.41. Additionally, in 2011, the Depredation Order for blackbirds, cowbirds, grackles, crows, and magpies (see 50 CFR 21.43(b)) was amended to include the requirement for use of non-toxic shot, as defined under 50 CFR 20.21(j), in most cases. However, this prohibition does not apply if an air rifle, an air pistol, or a .22 caliber rimfire firearm is used for control of depredating birds under the Order. To alleviate concerns associated with lead exposure in wildlife, WS would only use non-toxic shot as defined in 50 CFR 20.21(j) when using shotguns.

The take of birds by WS in the State would occur primarily from the use of shotguns. However, the use of rifles and air rifles could be employed to remove some species. To reduce risks to human safety and property damage from bullets passing through birds, the use of rifles and air rifles would be applied in such a way (*e.g*., caliber, bullet weight, distance) to ensure the bullet does not pass through birds, and if the bullet does pass through or misses the target, it impacts in a safe location. Birds that were removed using rifles and air rifles would occur within areas where retrieval of all bird carcasses for proper disposal would be highly likely (*e.g.*, at roost sites). With risks of lead exposure occurring primarily from ingestion of lead shot and bullet fragments, the retrieval and proper disposal of bird carcasses would greatly reduce the risk of scavengers ingesting or being exposed to lead that may be contained within the carcass.

However, deposition of lead into soil could occur if, during the use of a rifle or air rifle, the projectile passes through a bird, if misses occur, or if the bird carcass is not retrieved. Laidlaw et al. (2005) reported that, because of the low mobility of lead in soil, all of the lead that accumulates on the surface layer of the soil is generally retained within the top 20 cm (about 8 inches). In addition, concerns occur that lead from bullets deposited in soil from shooting activities could lead to contamination of ground water or surface water. Stansley et al. (1992) studied lead levels in water that was subjected directly to high concentrations of lead shot accumulation because of intensive target shooting at several shooting ranges. Lead did not appear to "*transport*" readily in surface water when soils were neutral or slightly alkaline in pH (*i.e*., not acidic), but lead did transport more readily under slightly acidic conditions. Although Stansley et al. (1992) detected elevated lead levels in water in a stream and a marsh that were in the shot "*fall zones*" at a shooting range, the study did not find higher lead levels in a lake into which the stream drained, except for one sample collected near a parking lot. Stansley et al. (1992) believed the

[14]The website can be accessed at http://www.dem.ri.gov/programs/bnatres/fishwild/pdf/relok8rs.pdf; accessed May 2, 2013.

lead contamination near the parking lot was due to runoff from the lot, and not from the shooting range areas. The study also indicated that even when lead shot was highly accumulated in areas with permanent water bodies present, the lead did not necessarily cause elevated lead levels in water further downstream. Muscle samples from two species of fish collected in water bodies with high lead shot accumulations had lead levels that were well below the accepted threshold standard of safety for human consumption (Stansley et al. 1992).

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

Since the take of birds could occur by other entities during regulated hunting seasons, through the issuance of depredation permits, under depredation orders, or without the need for a depredation permit, WS' assistance with removing birds would not be additive to the environmental status quo. WS' assistance would not be additive to the environmental status quo since those birds removed by WS using firearms could be lethally removed by the entities experiencing damage using the same method in the absence of WS' involvement. The amount of lead deposited into the environment may be lowered by WS' involvement in activities due to efforts by WS to ensure projectiles do no pass through, but are contained within the bird carcass, which would limit the amount of lead potentially deposited into soil from projectiles passing through the carcass. The proficiency training received by WS' employees in firearm use and accuracy increases the likelihood that birds are lethally removed humanely in situations that ensure accuracy and that misses occur infrequently, which would further reduce the potential for lead to be deposited in the soil from misses or from projectiles passing through carcasses. In addition, WS' involvement would ensure efforts were made to retrieve bird carcasses lethally removed using firearms to prevent the ingestion of lead in carcasses by scavengers. WS' involvement would also ensure carcasses were disposed of properly to limit the availability of lead. Based on current information, the risks associated with lead bullets that are deposited into the environment from WS' activities due to misses, the bullet passing through the carcass, or from bird carcasses that may be irretrievable would be below any level that would pose any risk from exposure or significant contamination. As stated previously, when using shotguns, only non-toxic shot would be used by WS pursuant to 50 CFR 20.21(j). Additionally, WS may utilize non-toxic ammunition in rifles and air rifles as the technology improves and ammunition become more effective and available.

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

Another issue often raised is that the dispersal of birds from a roost location to alleviate damage or conflicts at one site could result in new damage or conflicts at a new roost site. While the original complainant may see resolution to the bird problem when the roost is dispersed, the recipient of the bird roost may see the bird problem as imposed on them. Thus, overall, there is no resolution to the original bird problem (Mott and Timbrook 1988). Bird roosts usually are dispersed using a combination of harassment methods including pyrotechnics, propane cannons, effigies, and electronic distress calls (Booth 1994, Avery et al. 2008, Chipman et al. 2008). A similar conflict could develop when habitat alteration was used to disperse a bird roost. This concern would be heightened in large metropolitan areas

where the likelihood of birds dispersed from a roost finding a new roost location and not coming into conflict would be very low. WS and the USFWS have developed alternatives to minimize the potential of dispersing bird roosts in urban/suburban areas by evaluating a management option to depopulate a bird roost.

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

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

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

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

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

CHAPTER 3: ALTERNATIVES

Chapter 3 contains a discussion of the alternatives 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 Rhode Island are also discussed in Chapter 3.

3.1 DESCRIPTION OF THE ALTERNATIVES

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

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

The proposed action/no action alternative would continue the current implementation of an adaptive integrated approach utilizing non-lethal and lethal techniques, as deemed appropriate using the WS Decision Model (Slate et al. 1992; see WS Directive 2.201) to reduce damage and threats caused by birds in Rhode Island. A major goal of the program would be to alleviate and prevent bird damage and to reduce threats to human safety[15]. To meet this goal, WS, in cooperation the USFWS and consultation with the RIDEM, would continue to respond to requests for assistance with, at a minimum, technical assistance, or when funding was available, operational damage management.

Therefore, under this alternative, WS could respond to requests for assistance by: 1) taking no action, if warranted, 2) providing only technical assistance to property owners or managers on actions they could take to reduce damages caused by birds, or 3) providing technical assistance and direct operational assistance to a property owner or manager experiencing damage. Funding for activities conducted by WS could occur through federal appropriations; however, in most cases, those entities requesting assistance would provide the funding for activities conducted by WS.

A key component of assistance provided by WS would be providing information to the requester about wildlife and wildlife damage. Education is an important element of activities because wildlife damage management is about finding balance and coexistence between the needs of people and needs of wildlife. This is extremely challenging as nature has no balance, but rather is in continual flux. When responding to a request for assistance, WS would provide those entities with information regarding the use of appropriate methods. Property owners or managers requesting assistance would be provided with information regarding the use of effective and practical techniques and methods. In addition to the routine dissemination of recommendations and information to individuals or organizations experiencing damage, WS provides lectures, courses, and demonstrations to producers, homeowners, state and county agents, colleges and universities, and other interested groups. WS frequently cooperates with other entities in education and public information efforts. Additionally, technical papers are presented at professional meetings and conferences so that other wildlife professionals and the public are periodically updated on recent developments in damage management technology, programs, laws and regulations, and agency policies. Providing information about bird damage and methods would be a primary component of technical assistance and direct operational assistance available from WS under this alternative.

The WS program in Rhode Island regularly provides technical assistance to individuals, organizations, and other federal, state, and local government agencies for managing bird damage. Technical assistance includes collecting information about the species involved, the extent of the damage, and previous methods that the cooperator has employed to alleviate the problem. WS would then provide information on appropriate methods that the cooperator may consider to alleviate the damage themselves. Types of technical assistance projects may include a visit to the affected property, written communication, telephone conversations, or presentations to groups such as homeowner associations or civic leagues. Between FY 2006 and FY 2012, WS has conducted 140 technical assistance projects in Rhode Island associated with birds addressed in this assessment. Technical assistance provided by WS would occur as described in Alternative 2 of this EA.

Direct operational damage management assistance would include damage management activities that would be directly conducted by or supervised by personnel of WS. Operational damage management

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

assistance may be initiated when the problem cannot effectively be alleviated through technical assistance alone and there was a MOU, cooperative service agreement, or other comparable document signed between WS and the entity requesting assistance. The initial investigation would define the nature, history, and extent of the problem; species responsible for the damage; and methods available to alleviate the problem.

Under this alternative, the WS program would follow the "*co-managerial approach*" to solve wildlife damage or conflicts as described by Decker and Chase (1997). Within this management model, WS could provide technical assistance regarding the biology and ecology of birds and effective, practical, and reasonable methods available to a local decision-maker(s) to reduce damage or threats. WS and other state and federal wildlife management agencies may facilitate discussions at local community meetings when resources are available. Those entities requesting assistance could choose to use the services of private businesses, use volunteer services of private organizations, implement WS' recommendations on their own (*i.e*., technical assistance), request direct assistance from WS (*i.e*., direct operational assistance), or take no action. Generally, a decision-maker seeking assistance would be part of a community, municipality, business, governmental agency, and/or a private property owner.

Under a community based decision-making process, WS would provide information, demonstration, and discussion on all available methods to the appropriate representatives of the community for which services were requested to ensure a community-based decision was made. By involving decision-makers in the process, damage management actions can be presented to allow decisions on damage management to involve those individuals that the decision-maker(s) represents. As addressed in this EA, WS would provide technical assistance to the appropriate decision-maker(s) to allow for information on damage management activities to be presented to those persons represented by the decision-maker(s), including demonstrations and presentation by WS at public meetings to allow for involvement of the community. Requests for assistance to manage birds often originate from the decision-maker(s) based on community feedback or from concerns about damage or threats to human safety. As representatives, the decision-maker(s) are able to provide the information to local interests either through technical assistance provided by WS or through demonstrations and presentations by WS on activities to manage damage. This process allows decisions on activities to be made based on local input.

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

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

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

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

In general, the most effective approach to resolving damage would be to integrate the use of several methods simultaneously or sequentially. This adaptive approach to managing damage associated with birds would integrate the use of the most practical and effective methods as determined by a site-specific evaluation for each request after applying the WS Decision Model. The philosophy behind an adaptive approach would be to integrate the best combination of methods in a cost-effective[16] manner while minimizing the potentially harmful effects on humans, target and non-target species, and the environment. Integrated damage management may incorporate cultural practices (*e.g.*, animal husbandry), habitat modification (*e.g.*, exclusion, vegetation management), animal behavior modification (*e.g.*, scaring, repellents), removal of individual offending animals (*e.g.*, trapping, shooting, and avicides), and local population reduction, or any combination of these, depending on the circumstances of the specific damage problem.

When WS received a request for direct operational assistance, WS would conduct site visits to assess the damage or threat of damage, would identify the species responsible, and would apply the Decision Model described by Slate et al. (1992) and WS Directive 2.201 to determine the appropriate methods to alleviate or prevent damage. WS' personnel would assess the damage or threat of damage and then evaluate the appropriateness and availability (legal and administrative) of strategies and methods that would be based on biological, economic, and social considerations. Following this evaluation, methods that were deemed practical for the situation would be incorporated into a strategy to alleviate or prevent damage. After this strategy was implemented, monitoring would be conducted and evaluation would continue to assess the effectiveness of the strategy. If the strategy were effective at alleviating or preventing damage, the need for further management would be ended. In terms of the WS Decision Model, most efforts would consist of continuous feedback between receiving the request and monitoring the results of the strategy to alleviate or prevent damage. The Decision Model is not a written documented process, but a mental problem-solving process common to most, if not all, professions, including WS. WS' Decision Model would be the implementing mechanism for selecting methods under the proposed action alternative that would be adapted to each request.

Methods available to alleviate or prevent damage under this alternative could be considered lethal methods or non-lethal methods. Preference would be given to non-lethal methods when practical and effective under this alternative (see WS Directive 2.101). Non-lethal methods that would be available for use by WS would include, but would not be limited to, habitat/behavior modification, nest/egg

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

destruction, lure crops, visual deterrents, live traps, translocation, exclusionary devices, frightening devices, alpha chloralose, reproductive inhibitors, and chemical repellents (see Appendix B for a complete list and description of potential methods). Lethal methods that would be available to WS would include live-capture followed by euthanasia, DRC-1339, the recommendation of take during hunting seasons, and firearms. Euthanasia of live-captured birds would occur in accordance with WS Directive 2.505. WS would employ cervical dislocation or carbon dioxide to euthanize target birds once those birds were live-captured using other methods. Carbon dioxide would be an acceptable form of euthanasia for birds while cervical dislocation would be a conditionally acceptable[17] method of euthanasia (AVMA 2007). The use of firearms could also be used to euthanize birds live-captured; however, the use of firearms for euthanasia would be considered a conditionally acceptable method for wildlife (AVMA 2007).

As discussed in Chapter 1, the lethal removal of many bird species to alleviate damage would be prohibited unless authorized by the USFWS pursuant to the MBTA. The take of birds can only legally occur through the issuance of a depredation permit by the USFWS and only at levels specified in the permit, unless those bird species are afforded no protection under the MBTA or a depredation/control order has been established by the USFWS, in which case, no permit for take would be required. For some bird species (*e.g.*, waterfowl, turkeys, crows), lethal take can occur during a hunting season. In addition, a permit from the RIDEM may be required to alleviate damage caused by birds in the State. In most cases, the use of non-lethal dispersal methods and the destruction of inactive nests would not require a permit from the USFWS and/or the RIDEM.

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

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

Under this alternative, WS would provide those cooperators requesting assistance with technical assistance only. Technical assistance would provide those cooperators experiencing damage or threats associated with birds with information, demonstrations, and recommendations on available and appropriate methods available. The implementation of methods and techniques to alleviate or prevent damage would be the responsibility of the requester with no direct involvement by WS. In some cases, WS may provide supplies or materials that were of limited availability for use by private entities (*e.g.*, loaning of propane cannons). Similar to the proposed action alternative, a key component of assistance provided by WS would be providing information to the requester about wildlife and wildlife damage. Educational efforts conducted under the proposed action alternative would be similar to those conducted under this alternative.

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

Technical assistance would include collecting information about the species involved, the nature and extent of the damage, and previous methods that the cooperator has attempted to alleviate the problem. WS would then provide information on appropriate methods that the cooperator may consider to alleviate the damage themselves. Types of technical assistance projects may include a visit to the affected property, written communication, telephone conversations, or presentations to groups such as homeowner associations or civic leagues.

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

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

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

Alternative 3 – No Bird Damage Management Conducted by WS

This alternative would preclude any activities by WS to reduce threats to human health and safety, and alleviate damage to agricultural resources, property, and natural resources. WS would not be involved with any aspect of bird damage management in the State. All requests for assistance received by WS to alleviate damage caused by birds would be referred to the USFWS, to the RIDEM, and/or to private entities. This alternative would not deny other federal, State, and/or local agencies, including private entities, from conducting damage management activities directed at alleviating damage and threats associated with birds in the State. Therefore, under this alternative, entities seeking assistance with addressing damage caused by birds could contact WS but WS would immediately refer the requester to other entities. The requester could then contact other entities for information and assistance, could take actions to alleviate damage without contacting any entity, or could take no further action.

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

3.2 ALTERNATIVES CONSIDERED BUT NOT ANALYZED IN DETAIL WITH RATIONALE

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

Non-lethal Methods Implemented by WS before Lethal Methods

This alternative would require that non-lethal methods or techniques described in Appendix B be applied to all requests for assistance to reduce damage and threats to safety from birds in the State. If the use of non-lethal methods failed to alleviate the damage situation or reduce threats to human safety at each damage situation, lethal methods would be employed to alleviate 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 alleviate 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) would be similar to a non-lethal before lethal alternative because the use of non-lethal methods would be considered before lethal methods by WS (see WS Directive 2.101). Adding a non-lethal before lethal alternative and the associated analysis would not add additional information to the analyses in this EA.

Use of Non-lethal Methods Only by WS

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

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

Exclusionary devices can be effective in preventing access to resources in certain circumstances. The primary exclusionary methods are netting and overhead lines. Exclusion is most effective when applied to small areas to protect high value resources. However, exclusionary methods are neither feasible nor effective for protecting human safety, agricultural resources, or native wildlife species from birds across large areas. The non-lethal methods used or recommended by WS under this alternative would be identical to those identified in any of the alternatives. WS would not apply for a depredation permit from

the USFWS or the RIDEM under this alternative since no take of birds would occur unless nests or eggs were destroyed, when required.

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

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

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

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

Use of Lethal Methods Only by WS

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

Trap and Translocate Birds Only by WS

Under this alternative, all requests for assistance would be addressed using live-capture methods or the recommendation of live-capture methods. Birds could be live-captured using alpha chloralose, live-traps, cannon nets, rocket nets, bow nets, or mist nets. All birds live-captured through direct operational assistance by WS would be translocated. Prior to live-capture, release sites would be identified and approved by the USFWS, the RIDEM, and/or the property owner where the translocated birds would be placed prior to live-capture and translocation. Translocation of all birds is currently prohibited by RIDEM regulations, without prior approval of the RIDEM.

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 RIDEM. Therefore, the translocation of birds by WS would only occur as directed by those agencies. When requested by the USFWS and/or the RIDEM, WS could translocate birds under any of the alternatives analyzed in detail, except under the no involvement by WS alternative (Alternative 3). However, birds could be translocated by other entities to alleviate damage under Alternative 3. Since WS does not have the authority to translocate birds in the State unless permitted by the USFWS and/or the RIDEM, this alternative was not considered in detail.

The translocation of birds causing damage to other areas following live-capture generally would not be effective or cost-effective. Translocation is generally ineffective because problem bird species are highly mobile and can easily return to damage sites from long distances, habitats in other areas are generally already occupied, and translocation would most likely result in bird damage problems at the new location. In addition, hundreds or thousands of birds would need to be captured and translocated to solve some damage problems (*e.g.*, urban crow roosts); therefore, translocation would be unrealistic in those circumstances. Translocation of wildlife is also discouraged by WS policy (see WS Directive 2.501) because of the stress to the translocated animal, poor survival rates, and the difficulties that translocated wildlife have with adapting to new locations or habitats (Nielsen 1988).

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

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

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

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

the adoption of reproductive control technologies as a wildlife management tool for some species. Currently, no reproductive inhibitors are available for use to manage most bird populations. Given the costs associated with live-capturing and performing sterilization procedures on birds and the lack of availability of chemical reproductive inhibitors for the management of most bird populations, this alternative was not evaluated in detail.

If a reproductive inhibitor becomes available to manage a large number of bird populations and proven effective in reducing localized bird populations, the use of the inhibitor could be evaluated as a method available under the alternatives. This EA would be reviewed and supplemented to the degree necessary to evaluate the use of the reproductive inhibitor. Currently, the only reproductive inhibitor registered with the EPA is nicarbazin, which is registered for use to manage local populations of Canada geese, domestic mallards, Muscovy ducks, other feral waterfowl, and rock pigeons. However, the only reproductive inhibitor available in Rhode Island currently is the formulation of nicarbazin to manage pigeon populations. Reproductive inhibitors for the other bird species addressed in this EA do not currently exist.

Compensation for Bird Damage

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

3.3 STANDARD OPERATING PROCEDURES FOR BIRD DAMAGE MANAGEMENT

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

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

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

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

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

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

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

- Management actions would be directed toward specific species or individual animals posing a threat to human health and safety, causing agricultural damage, causing damage to natural resources, or causing damage to property.

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

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

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

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

- Only non-toxic shot would be used when employing shotguns pursuant to 50 CFR 20.21(j).

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

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, by the USFWS, and by the RIDEM to evaluate population trends and the magnitude of cumulative take of birds in the State.

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

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

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

- Preference would be given to non-lethal methods, when practical and effective.

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

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

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

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

captures.

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

- Personnel would be present during the use of live-capture methods or live-traps would be checked at least every 24 hours to ensure non-target species were released immediately or were prevented from being captured.

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

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

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

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

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

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

- The use of firearms would occur during times when public activity and access to the control areas was restricted, when possible. Personnel involved in the use of firearms would be fully trained in the proper and safe application of this method.

- All personnel employing chemical methods would be properly trained and certified in the use of those chemicals. All chemicals used by WS would be securely stored and properly monitored to ensure the safety of the public. WS' use of chemicals and training requirements for those chemicals are outlined in WS Directive 2.401 and WS Directive 2.430.

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

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

Issue 4 - Effects on the Aesthetic Values of Birds

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

- All methods or techniques applied to alleviate damage or threats to human safety would be agreed

upon by entering into a cooperative service agreement, MOU, or comparable document prior to the implementation of those methods.

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

Issue 5 - Humaneness and Animal Welfare Concerns of Methods

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

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

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

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

- The use of non-lethal methods would be considered prior to the use of lethal methods when managing bird damage.

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

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

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

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

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

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

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

Issue 7 - Effectiveness of Bird Damage Management Methods

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

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

CHAPTER 4: ENVIRONMENTAL CONSEQUENCES

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

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

4.1 ENVIRONMENTAL CONSEQUENCES FOR ISSUES ANALYZED IN DETAIL

This section analyzes the environmental consequences of each alternative in comparison to determine the extent of actual or potential impacts on the issues. Therefore, the proposed action/no action alternative serves as the baseline for the analysis and the comparison of expected impacts among the alternatives. The analysis also takes into consideration mandates, directives, and the procedures of WS, the USFWS, and the RIDEM.

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

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

As discussed previously, methods available to address bird damage or threats of damage in the State that would be available for use or recommendation by WS under Alternative 1 (technical and operational assistance) and Alternative 2 (technical assistance only) are either lethal methods or non-lethal methods. Under Alternative 2, WS could recommend lethal and non-lethal methods as part of an integrated approach to resolving requests for assistance but would provide no direct operational assistance. Alternative 1 addresses requests for assistance received by WS through technical and operational assistance where an integrated approach to methods could be employed and/or recommended. Non-lethal methods would include, but would not be limited to habitat/behavior modification, lure crops, visual deterrents, lasers, live traps, translocation, alpha chloralose, nest/egg destruction, exclusionary devices, frightening devices, nets, nests/egg destruction, immobilizing drugs, and chemical repellents (see Appendix B for a complete list and description of potential methods). Lethal methods considered by WS to address bird damage include live-capture followed by euthanasia, DRC-1339, shooting, and the recommendation of hunting, where appropriate. Birds would be euthanized using cervical dislocation or

carbon dioxide once birds were live-captured using other methods. Carbon dioxide is an acceptable form of euthanasia for birds while cervical dislocation is a conditionally acceptable[18] method of euthanasia (AVMA 2007). No assistance would be provided by WS under Alternative 3 but many of those methods available to address bird damage would continue to be available for use by other entities under Alternative 3.

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

The use of non-lethal methods in an integrated approach has proved effective in dispersing birds. For example, Avery et al. (2002) and Seamans (2004) found that the use of vulture effigies were an effective non-lethal method to disperse roosting vultures. Non-lethal methods have been effective in dispersing crow roosts (Gorenzel et al. 2000, Chipman et al. 2008), including the use of crow effigies (Avery et al. 2008), lasers (Gorenzel et al. 2002), and electronic distress calls (Gorenzel and Salmon 1993). Chipman et al. (2008) found the use of only non-lethal methods to disperse urban crow roosts often requires a long-term commitment of affected parties, including financial commitments, to achieve and maintain the desired result of reducing damage.

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

The continued use of non-lethal methods often leads to the habituation of birds to those methods, which can decrease the effectiveness of those methods (Avery et al. 2008, Chipman et al. 2008). For any management methods employed, the proper timing would be essential in effectively dispersing those birds causing damage. Employing methods soon after damage begins or soon after threats were identified would increase the likelihood that those damage management activities would achieve success in addressing damage. Therefore, coordination and timing of methods is necessary to be effective in achieving expedient resolution of bird damage. The use of non-lethal methods would not have adverse impacts on populations of birds in the State under any of the alternatives.

Lethal methods would be employed or recommended to alleviate damage associated with those birds identified by WS as responsible for causing damage or threats to human safety only after receiving a request for the use of those methods. The use of lethal methods could result in local population reductions in the area where damage or threats were occurring since birds would be removed from the

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

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

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

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

The avicide DRC-1339 could also be used under the proposed action and applied as part of an integrated approach. The intent in using DRC-1339 would be to reduce the number of birds present at a location where damages or threats of damage were occurring. Reducing the number of birds at a location where damage or threats were occurring either using non-lethal methods or lethal methods can lead to a reduction in damage. The dispersal of birds using non-lethal methods can reduce the number of birds using a location, which has been correlated with a reduction in damage occurring at that location (Avery et al. 2008, Chipman et al. 2008). This scenario could occur if lethal methods were employed. Similarly, the use of DRC-1339 is intended to reduce the number of birds using a location. Boyd and Hall (1987) found the use of DRC-1339 to reduce local crow roosts by up to 25% could lead to a reduction in damage associated with those crows.

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

Chipman et al. (2008) found that crows returned to roosts previously dispersed using non-lethal methods within two to eight weeks. In addition, Chipman et al. (2008) found that the use of non-lethal methods had to be re-applied every year during a six-year project that evaluated the use of only non-lethal methods. At some roost locations, Chipman et al. (2008) found the number of crows that returned each year to roosts over a six-year period actually increased despite the use of non-lethal methods each year. Despite the need to re-apply non-lethal methods yearly, the return of birds to roost locations previously

dispersed, and the number of crows using roost locations increasing annually at some roost locations, Chipman et al. (2008) determined the use of non-lethal methods could be effective at dispersing urban crow roosts in New York. Similar results were found by Avery et al. (2008) during the use of crow effigies and other non-lethal methods to disperse urban crow roosts in Pennsylvania. Crows returned to roost locations in Pennsylvania annually despite the use of non-lethal methods and effigies (Avery et al. 2008). Gorenzel et al. (2002) found that crows returned to roost locations after the use of lasers. Therefore, the use of both lethal and non-lethal methods may require repeated use of those methods. The return of birds to areas where damage management methods were previously employed does not indicate previous use of those methods were ineffective since the intent of those methods would be to reduce the number of birds present at a site where damage was occurring at the time those methods were employed.

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

WS may recommend birds be harvested during the regulated hunting season for those species in an attempt to reduce the number of birds causing damage. Managing bird populations over broad areas could lead to a decrease in the number of birds causing damage. Establishing hunting seasons and the allowed take during those seasons is the responsibility of the RIDEM under frameworks developed by the USFWS. WS does not have the authority to establish hunting seasons or to set allowed harvest numbers during those seasons.

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

The issue of the potential impacts of conducting the alternatives on the populations of target bird species is analyzed for each alternative below.

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

WS would work with those persons experiencing bird damage with 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 could be difficult to alleviate using available methods since birds would be conditioned to feed, roost, loaf, and would be familiar with a particular location. Subsequently, making that area unattractive using available methods could be difficult to achieve once damage was ongoing. WS would work closely with those entities requesting assistance to identify situations where damage could occur and begin to implement damage

management activities under this alternative as early as possible to increase the likelihood of those methods achieving the level of damage reduction requested by the cooperating entity. WS would employ and/or recommend those methods described in Appendix B in an adaptive approach that would integrate methods to reduce damage and threats associated with birds in the State. Under the proposed action alternative, WS could employ only non-lethal methods when determined to be appropriate for each request for assistance to alleviate damage or reduce threats of damage using the WS Decision Model. However, could also use or recommend the use of lethal methods under this alternative. When employing lethal methods, a depredation permit may be required from the USFWS and/or the RIDEM.

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

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

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

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

Therefore, the USFWS could: 1) deny WS' application for a depredation permit, 2) issue a depredation permit for the take of birds at a level below the number requested by WS, or 3) issue a depredation permit for the number of birds requested by WS. In addition, WS could be listed as subpermittees under depredation permits issued to other entities. The issue of the effects on target bird species arises from the use of non-lethal and lethal methods to address the need for reducing damage and threats; however, the primary concern would be from the use of lethal methods to address damage. The lethal take of birds would be monitored by comparing numbers of animals killed with overall populations or trends in populations to assure the magnitude of take is maintained below the level that would cause significant adverse effects to the viability of native species' populations. The potential impacts on the populations of target bird species from the implementation of the proposed action are analyzed for each species below.

Mute Swan Biology and Population Impact Analysis

The mute swan is a large, all-white swan recognized by its orange bill that is black at its base. There is also a prominent black knob at the base of its bill. Another distinctive characteristic is the graceful curved neck held in an S-shape with the bill pointed downward while the bird is swimming. The male mute swan, or cob, is usually larger with a more prominent knob on his forehead but is otherwise identical to the female, or pen. Young swans, called cygnets, are usually white, but gray-colored cygnets are common (Ciaranca et al. 1997, Connecticut Department of Energy and Environmental Protection 1999).

The mute swan was introduced from Europe into the United States in the late 1800s near New York City. An additional 544 swans were introduced into the lower Hudson Valley in 1910 and on Long Island in 1912. In the eastern United States, scattered breeding now occurs from New Hampshire to South Carolina (Master 1992, Ciaranca et al. 1997). Feral populations became established over time as swans that had escaped or been intentionally released from captivity survived and reproduced in the wild. Mute swans prefer freshwater ponds and streams of 10 acres or less and coastal bays and salt marshes. Eastern birds migrate short distances to coastal bays for the winter. The swan's diet consists mostly of rooted aquatic vegetation. Small islands, narrow peninsulas, and clumps of aquatic vegetation are preferred nesting sites.

Mute swans often have negative effects on the environment by consuming large quantities of submerged aquatic vegetation that are essential to native fish and wildlife species. Fenwick (1983) found that female mute swans in Chesapeake Bay consume an average of 43% of their body weight daily while male mute swans could consume an average of 35% of their body weight daily. Thus, large concentrations of mute swans can have devastating effects on submerged aquatic vegetation beds essential to many fish, wildlife, and invertebrate species.

Most mute swans breed at age three and remain with the same mate for life. Courtship display begins in late February and each pair vigorously defends their territory from other swans and other wildlife (Ciaranca et al. 1997, Connecticut Department of Energy and Environmental Protection 1999). Nesting territories vary in size from 1.6 to 4 ha (4 to 10 acres) and are used year-round or reoccupied each year. 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 (Ciaranca et al. 1997, Connecticut Department of Energy and Environmental Protection 1999).

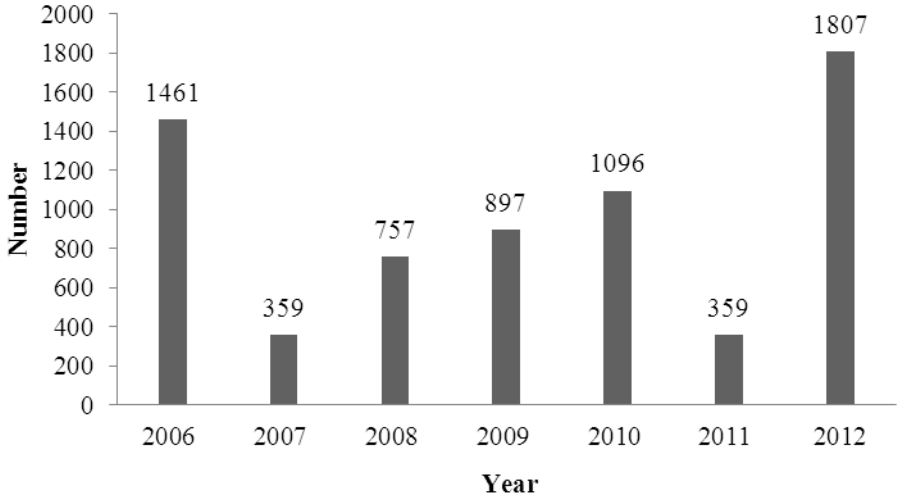
The first report of mute swans in Rhode Island occurred on Block Island in 1923 (Willey and Halla 1972). Nesting attempts of the birds were first observed on Briggs Marsh, Little Compton in 1948 (RIDEM 2006). The RIDEM (2006) estimated the statewide resident population at approximately 1,400 swans in 2005. The 2002 and 2008 Mid-Summer Mute Swan Surveys indicated populations of 1,367 and 856

swans, respectively, in Rhode Island (Atlantic Flyway Council 2003, Atlantic Flyway Council 2009). Of the swans surveyed in 2008, 33 were cygnets from 10 individual broods, averaging 3.3 cygnets per brood.

Population trend data from the BBS shows increasing populations of mute swans in the Eastern BBS Region and New England/Mid-Atlantic Region at rates of 4.0% and 2.8%, respectively (Sauer et al. 2012). BBS trend data for mute swans is currently not available for Rhode Island. Data from the CBC conducted from 1966 to 2011 shows the number of swans observed per party hour has experienced a declining trend (NAS 2010). From 2006 to 2011, data from the CBC indicates decreasing trends in both the number and number per party hour of mute swans observed in Rhode Island.

The number of mute swans estimated in the State from the Breeding Waterfowl Survey, conducted between 2006 and 2012, are shown in Figure 4.1. The number of mute swans observed in the State during the Atlantic Flyway Breeding Waterfowl Plot Survey conducted in 2012 was estimated at 1,807 up from 359 in 2011 (Klimstra and Padding 2012). The 5-year average for mute swans observed in Rhode Island during the Atlantic Flyway Breeding Waterfowl Plot Survey is 983 swans. The International Union for Conservation of Nature and Natural Resources (IUCN) ranks the mute swan as a species of least concern (BirdLife International 2012).

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



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

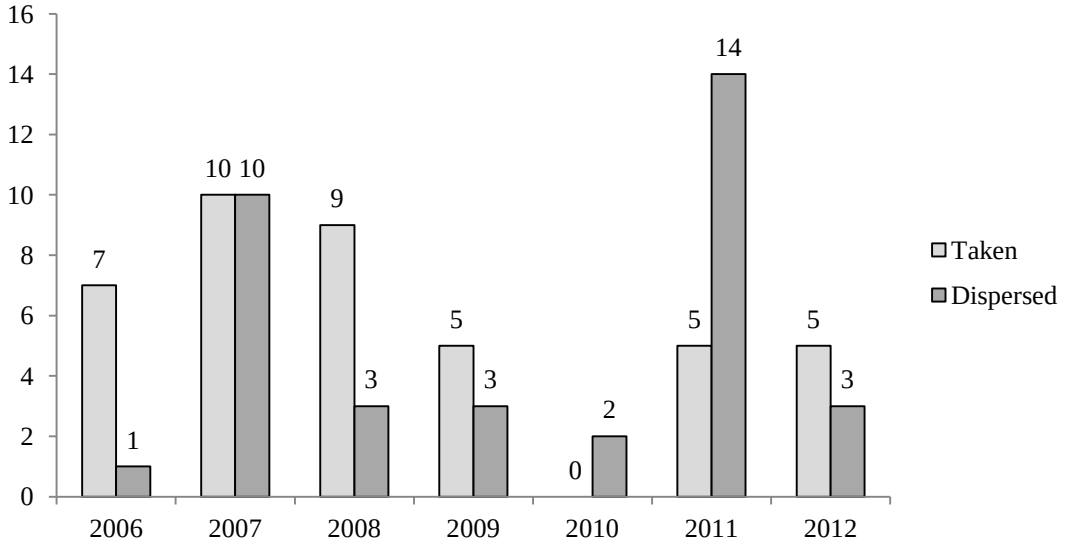
In 2003, the Atlantic Flyway Council adopted a Mute Swan Management Plan with the goals of reducing mute swan populations in the flyway to levels that would minimize negative impacts on wetland habitats and native waterfowl, and prevent range expansion into unoccupied areas. To minimize negative impacts on wetlands and native waterfowl, the Plan calls for a reduction of the mute swan population in the

Atlantic Flyway to less than 3,000 swans by 2013 (Atlantic Flyway Council 2003). During a survey conducted along the Atlantic Flyway in 2008, the population of mute swans was estimated at 10,541 swans (Atlantic Flyway Council 2009). During the 2012 Atlantic Flyway Breeding Waterfowl Plot Survey, Klimstra and Padding (2012) estimated a population of 30,606 swans in Massachusetts, Connecticut, Rhode Island, New York, Pennsylvania, New Jersey, and Maryland.

In 2002, the statewide population of mute swans in Rhode Island was estimated at 1,367 swans (Atlantic Flyway Council 2003, Atlantic Flyway Council 2009). The target population in the State is 300 swans (Atlantic Flyway Council 2003). During the mute swan survey conducted in 2008, the number of mute swans in the State was estimated at 856 swans (Atlantic Flyway Council 2009). As mentioned previously, the data from the Atlantic Flyway Breeding Waterfowl Plot Survey conducted in 2012 indicated a population of 1,807 swans in the State (Klimstra and Padding 2012).

From FY 2006 through FY 2012, 41 mute swans have been lethally removed by WS to alleviate damage and 36 swans were non-lethally dispersed (see Figure 4.2). In addition, WS destroyed 10 eggs in two mute swan nests from FY 2006 through FY 2012. Based on the number of requests received and the number of mute swans addressed previously to alleviate those threats, WS anticipates that up to 100 mute swans could be lethally taken annually in the State. In addition, WS could destroy the eggs in up to 50 mute swan nests through oiling, addling, puncturing, or breaking open the egg.

Figure 4.2 – Number of mute swans addressed by WS in Rhode Island 2006 to 2012



The lethal removal of up to 100 mute swans annually would represent 11.7% of the minimum population estimated at 856 during the 2008 Mid-Summer Mute Swan Surveys. The lethal removal of up to 100 mute swans would represent 5.5% of the 1,807 mute swans observed during the Atlantic Flyway Breeding Waterfowl Plot Survey conducted in the State during 2012 and 10.2% of the 5-year average of mute swans observed in Rhode Island during the survey. Because mute swans are considered a non-native species and a target population of 300 mute swans has been set under the Atlantic Flyway Mute Swan Management Plan for Rhode Island (Atlantic Flyway Council 2003), any lethal take by WS would occur within the Atlantic Flyway management goal. The goal of the Atlantic Flyway Council is to reduce the mute swan population in the Atlantic Flyway to a level that would minimize adverse effects to wetland habitats and native migratory birds and to prevent further range expansion into unoccupied areas (Atlantic Flyway Council 2003).

American Black Duck Biology and Population Impacts Analysis

The American black duck is a large dabbling duck found primarily in the eastern United States and Eastern Canada (Longcore et al. 2000). Breeding populations occur in eastern Canada southward into the northeastern United States and the Great Lakes region (Longcore et al. 2000). Black ducks can be found wintering from the east-central United States south of the Great Lakes into the southeastern United States (Longcore et al. 2000). Black ducks can be found in a variety of wetland types throughout the year, including freshwater wetlands, lakes, ponds, streams, and bogs in mixed hardwood and boreal forests, and salt marshes. The fall migration begins from September to early October as birds begin congregating near breeding areas. Breeding begins in February in the southern portion of their breeding range and may not begin until late-May in the northern portions of the range (Longcore et al. 2000). Migrants feed on seeds, foliage, aquatic tubers, invertebrates, agricultural grains, and they are known to feed of fish and amphibians (Longcore et al. 2000).

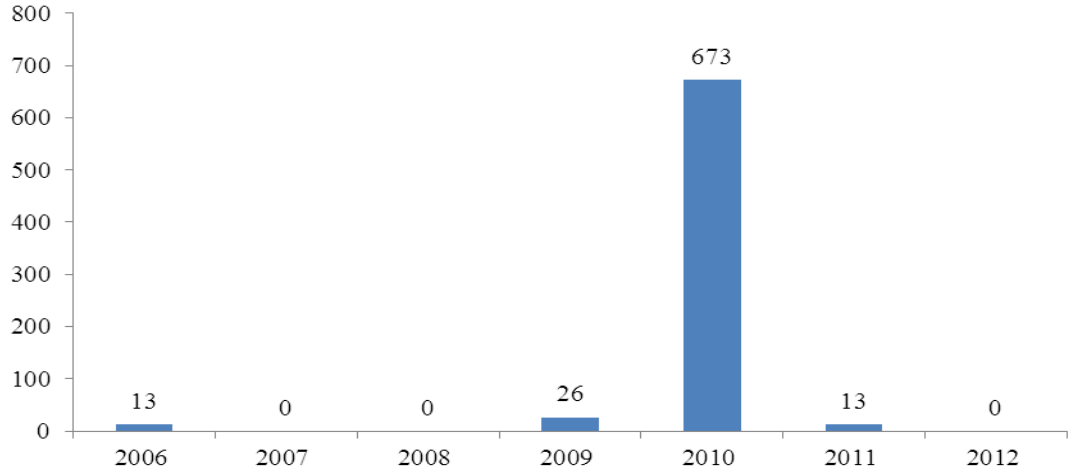
Male and female American black ducks are similar and have an almost uniformly dark brown body with a contrasting grayish head. The speculum, or wing patch, is all purple, lacking the mallards white border, and is visible in good light. The legs are reddish and the bill is a pale yellow, which is brighter in males. In flight, American black ducks can be distinguished from mallards by their highly contrasting bright silver under wing (NAS 2012). The American black duck is closely related to the mallard and regularly hybridizes with mallards. Black ducks are among the largest of North American ducks and can be found in just about any aquatic habitat type within its range as long as there is adequate cover present.

The highest breeding densities can be 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 Canadian Maritime Provinces to Florida. Highest concentrations are found wintering between Long Island, New York and North Carolina (Ducks Unlimited 2012). Black duck populations are susceptibility to over-hunting and other pressures, which have resulted in a continual population decline over the past century (NAS 2012).

From 1966 to 2011, the number of American black ducks observed in the Eastern BBS region has decreased at an estimated annual rate of -0.5%; however, from 2001 through 2011, the number of ducks observed during the BBS has increased at an estimated rate of 1.1% annually (Sauer et al. 2012). In the New England/Mid-Atlantic Coast region, the number of black ducks observed in areas surveyed during the BBS has shown a declining trend estimated at -5.9% annually from 1966 through 2011, with a -4.0% annual decline occurring from 2001 through 2011 (Sauer et al. 2012). There is no BBS trend data for American black ducks available for Rhode Island (Sauer et al. 2012). The number of American black ducks observed in the State during the CBC has shown a decreasing trend from 1966 to 2011 (NAS 2010). However, from 2000 to 2011, the number of black ducks observed during the CBC has shown an increasing trend (NAS 2010). The American black duck is ranked as a species of least concern by the BirdLife International (2012).

The numbers of American black ducks estimated in the State during the Atlantic Flyway Breeding Waterfowl Plot Survey conducted from 2006 to 2012 are shown in Figure 4.3. The number of American black ducks observed in the State during the Midwinter Waterfowl Survey conducted in 2012 was estimated at 1,937 American black ducks up from 1,816 in 2011. The 5-year average for American black ducks in Rhode Island from 2006 to 2010 is 2,003 ducks (Klimstra and Padding 2012).

Figure 4.3 – Breeding Waterfowl Survey population estimates for American black ducks, 2006 - 2012



Like other waterfowl species, American black ducks can be harvested during a regulated season in the State. An estimated 1,029 American black ducks were harvested in the State during 2009, 1,258 were harvested during 2010, and 384 were harvested in 2011 (Raftovich et al. 2011, Raftovich et al. 2012). In addition, Raftovich et al. (2011, 2012) estimated that 147 American black duck-mallard hybrids were harvested in the State during the 2009 season, 189 hybrids were harvested during the 2010 season, and 21 hybrids were harvested during the 2011 season. Since 2006, an estimated 8,863 American black ducks and 844 American black duck-mallard hybrids have been harvested in the State during the regulated season (see Table 4.1), which is an average of 1,266 American black ducks and 121 American black duck-mallard hybrids harvested annually from 2006 through 2012.

Table 4.1 – Number of American black ducks and American black duck-mallard hybrids harvested 2006 to 2012

Year	Hunter Harvest	
	American black duck	American Black Duck-Mallard Hybrid
2006	1,459	199
2007	1,466	96
2008	2,293	107
2009	974	85
2010	1,029	147
2011	1,258	189
2012	384	21
TOTAL	**8,863**	**844**

In addition to the take of American black ducks during the hunting season, WS has lethally removed 20 American black ducks and non-lethally dispersed 4,585 black ducks from FY 2006 through FY 2012 (see Table 4.2). No American black ducks have been lethally taken under depredation permits by non-WS' entities between 2006 and 2011. From 2006 through 2012, the take of American black ducks by WS represented 0.2% of the total number of American black ducks and American black duck-mallard hybrids harvested in Rhode Island during the regulated hunting season.

Based on the number of requests received for assistance previously and in anticipation of additional efforts, an annual take of up to 50 American black ducks by WS could occur under the proposed action. WS anticipates the number of airports requesting assistance with managing threats associated with

American black ducks on or near airport property will increase. Since 2006, the average number of American black ducks and American black duck-mallard hybrids harvested in the State has been estimated at 1,387 individuals. Based on the average annual take of American black ducks and hybrids from 2006 through 2012 during the hunting season, take of up to 50 American black ducks and hybrids by WS would have represented 3.6% of the estimated annual take in the State.

Table 4.2 – Number of American black ducks addressed in Rhode Island from 2006 to 2012

Year	Dispersed by WS[1]	Take under Depredation Permits			
		WS' Take[1]	Non-WS' Take Authorized[2]	Non-WS' Take[2]	Total Take by All Entities[2]
2006	249	1	5	0	1
2007	304	3	5	0	3
2008	455	1	5	0	1
2009	1,134	3	5	0	3
2010	637	0	5	0	0
2011	851	6	50	0	6
2012	955	6	50	0[†]	6
TOTAL	**4,585**	**20**	**125**	**0**	**20**

[1]Data reported by federal fiscal year
[2]Data reported by calendar year
[†]Data reports for 2012 are currently incomplete

Based on the known take of American black ducks in the State, take of up to 50 American black ducks annually by WS to alleviate damage would not adversely affect American black duck populations in Rhode Island. All take by WS would occur under a depredation permit issued by the USFWS and the RIDEM, which ensures the cumulative take of American black ducks from all known sources would be considered when establishing population objectives for American black ducks.

Mallard Biology and Population Impacts Analysis

Mallards are one of the most recognizable waterfowl species with a wide range across most of North America (Drilling et al. 2002). Mallards are considered the most abundant waterfowl species with the widest breeding range (Drilling et al. 2002). Mallards can be found wintering as far north as weather conditions allow. In Rhode Island, breeding and winter populations can be found in appropriate habitat statewide (Drilling et al. 2002). Breeding habitat varies as nesting occurs in primarily upland habitats with dense vegetation near water; however, nesting also occurs in agricultural fields, low woody cover, fallen logs, stands of dense saplings, dead treetops, hollow bases of trees, abandoned raptor or crow nests, and other dense herbaceous growth (Drilling et al. 2002).

Mallards were uncommon summer residents in Rhode Island in the early 1900s, but they are now one of the most common nesting waterfowl in the State. The local breeding stock originates from releases and escapees from captive flocks in the early to mid-1900s. Their population continues to expand, benefited by adapting to human influence (Environmental Data Center 2008).

Like other waterfowl species, mallards often form large flocks during the migration periods. Densities often increase as mallards move between wintering and breeding areas during the migration periods. The large flocks can pose increased risks when those flocks occur on airport property or in the surrounding area. Large flocks near airfields increases the likelihood of aircraft striking multiple birds, which increases damage and increases the potential for catastrophic failure of the aircraft to occur. Large flocks of mallards can also cause damage to agricultural resources, primarily by trampling and consuming sprouting crops in the spring. The fall migration period begins in early August and continues through

early-December with the peak occurring from early September through the end of November. The spring migration begins in early February and continues through early April with the peak occurring from mid-February through the end of May (Drilling et al. 2002).

From 1966 to 2011, the number of mallards observed in the Eastern BBS Region has decreased at an annual rate of -1.0%, with a 0.2% annual increase occurring from 2001 through 2010 (Sauer et al. 2012). In the New England/Mid-Atlantic Region, the number of mallards observed during the BBS has increased annually at an estimated rate of 1.9%, with a 0.3% annual increase occurring from 2001 through 2010 (Sauer et al. 2012). In Rhode Island, the number of mallards observed in areas surveyed during the BBS has also shown increasing trends estimated at 2.6% annually, with a 2.7% annual increase occurring from 2001 through 2011 (Sauer et al. 2012). The number of mallards observed during the CBC conducted annually in the State has shown increasing trends from 1966 to 2011 (NAS 2010). The mallard is ranked as a species of least concern by BirdLife International (2012).

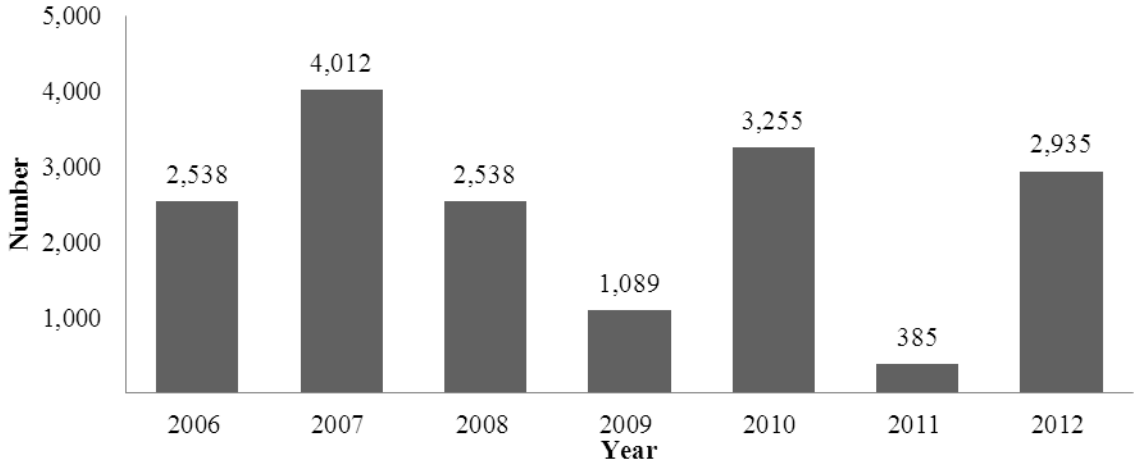
As shown in Figure 4.4, the number of mallards observed in the State during the Breeding Waterfowl Plot Survey conducted in the Atlantic Flyway from 2006 to 2012 has ranged from a low of 385 mallards observed in 2011 to a high of 4,012 mallards observed in 2007. The number of mallards observed in the State during the Midwinter Waterfowl Survey conducted in 2012 was estimated at 2,776 mallards, which represented an increase from the 1,389 mallards observed in 2011. From 2008 through 2012, 1,831 mallards have been observed per year on average during the Midwinter Waterfowl Survey conducted in Rhode Island (Klimstra and Padding 2012).

Like other waterfowl species, mallards can be harvested during a regulated hunting season in the State. An estimated 1,518 mallards were harvested in the State during 2009, 2,233 mallards were harvested in the State during 2010, and 512 mallards were harvested in 2011 (Raftovich et al. 2011, Raftovich et al. 2012). In addition, Raftovich et al. (2011) estimated that 31 domestic mallards were harvested in the State during the 2010 season. No domestic mallards were estimated as taken during the 2009 and 2011 seasons in Rhode Island (Raftovich et al. 2011, Raftovich et al. 2012). Since 2006, an estimated 12,774 mallards and 64 domestic mallards have been harvested in the State during the regulated season (see Table 4.3), which is an average of 1,825 mallards and 9 domestic mallards harvested annually from 2006 through 2012.

In addition to the take of mallards during the hunting season, 53 mallards have been lethally taken and 686 non-lethally dispersed by WS from FY 2006 through FY 2012. In addition, 27 mallards have been lethally taken under depredation permits by all non-WS' entities to alleviate damage in Rhode Island between 2006 and 2011 (see Table 4.4). From 2006 through 2012, the combined take of mallards by WS and non-WS' entities under depredation permits represented 0.6% of the total number of mallards and domestic mallards harvested in Rhode Island during the regulated hunting season from 2006 through 2012.

Based on the number of requests received for assistance previously and in anticipation of additional efforts, an annual take of up to 75 mallards by WS could occur under the proposed action. WS anticipates the number of airports requesting assistance with managing threats associated with mallards on or near airport property will increase. Since 2006, the average number of mallards harvested in the State per year has been estimated at 1,834 mallards, including domestic mallards. Based on the average number of mallards harvested from 2006 through 2012 during the hunting season, take of up to 75 mallards by WS would represent 4.1% of the estimated average annual harvest of mallards in the State.

Figure 4.4 – Breeding waterfowl survey population estimates for mallards, 2006 - 2012



Take of 75 mallards would represent 2.7% of the 2,776 mallards observed in Rhode Island during the Midwinter Waterfowl Survey conducted in 2012. Similarly, the take of 75 mallards by WS would represent 4.1% of the 1,831 mallards observed on average per year in Rhode Island during the Midwinter Waterfowl Survey between 2008 and 2012.

Table 4.3 – Number of mallards and domestic mallards harvested 2006 to 2012

Year	Hunter Harvest	
	Mallard	**Domestic Mallard**
2006	2,155	33
2007	2,135	0
2008	2,580	0
2009	1,641	0
2010	1,518	0
2011	2,233	31
2012	512	0
TOTAL	**12,774**	**64**

As shown in Table 4.4, the USFWS authorized the lethal removal of 100 mallards by non-WS entities during 2009 and 2010 in Rhode Island to alleviate damage or risks of damage, which has been the highest authorized take permitted between 2006 and 2012. If the USFWS continued to authorize the lethal take of up to 100 mallards per year, the combined take of WS and other entities could total 175 mallards. When combined with the highest level of take authorized by the USFWS in Rhode Island, take under depredation permits would represent 6.3% of the number of mallards estimated in the State during the 2012 Midwinter Waterfowl Survey and 9.6% of the average number of mallards observed on the Survey from 2008 through 2012.

Based on the known take of mallards in the State, take of up to 75 mallards annually by WS to alleviate damage and threats would not adversely affect mallard populations in Rhode Island. All take by WS would occur under a depredation permit issued by the USFWS and the RIDEM for the take of those mallards, which would ensure the cumulative take of mallards from all known sources, was considered when establishing population objectives for mallards.

Table 4.4 – Number of mallards addressed in from FY 2006 to FY 2012

Year	Dispersed by WS[1]	Take under Depredation Permits			
		WS' Take[1]	Non-WS' Take Authorized	Non-WS' Take[2]	Total Take by All Entities[2]
2006	16	3	55	1	4
2007	79	1	30	0	1
2008	4	0	25	0	0
2009	50	2	100	3	5
2010	123	1	100	23	24
2011	106	0	75	30	30
2012	308	46	75	N/A[†]	46
TOTAL	**686**	**53**	**460**	**57**	**110**

[1]Data reported by federal fiscal year
[2]Data reported by calendar year
[†]N/A=information not currently available; data reports for 2012 are currently incomplete

Eastern Wild Turkey Biology and Population Impacts Analysis

Wild turkeys found in Rhode Island consist of the Eastern wild turkey subspecies that is endemic to the eastern half of the United States (Kennamer 2010). 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). There are six distinct subspecies of wild turkeys in North America, with the Eastern wild turkey subpopulation being the most abundant and most widely distributed. 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 residents in States where they are present and are considered non-migratory. 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).

Turkeys were extirpated from Rhode Island by the early 1700s, likely from overharvest. They were reintroduced by the RIDEM in 1980, when 29 wild turkeys, trapped and donated by the Vermont Department of Fish and Wildlife, were released in the State. Releases of turkeys also occurred in the early 1990s. Today wild turkeys are found throughout the state wherever forests and open lands exist. In some cases, due to their adaptability, turkeys have encroached into urban areas where they are sometimes unwelcome (Tefft 2009).

The RIDEM estimated the statewide population at 4,000 turkeys in 2010. The estimated population has declined from a peak of 6,000 birds in 2002 (Tefft 2012). The numbers of turkeys observed during the BBS in the Eastern BBS Region and New England/Mid-Atlantic Region have shown increasing trends estimated at 10.7% and 18.7%, respectively, between 1966 and 2011 (Sauer et al. 2012). There is no trend estimate available for turkeys in Rhode Island. After first being observed during the CBC in 1979 until 2011, the total number and the number of turkeys observed per party hour in the State during the CBC have shown increasing trends (NAS 2010). The Eastern wild turkey is ranked as a species of least concern by BirdLife International (2012).

Today, populations of turkeys in the State are sufficient to allow for annual hunting seasons. The numbers of turkeys harvested in the State from 2006 through 2012 are shown in Table 4.5. Bearded turkeys, typically males, can be harvested in the State during the annual spring Regular Hunting Season, Special Paraplegic Season, and Junior Turkey Hunting Weekend. Both firearms and archery are allowed during these seasons. Either sex birds can be taken during the annual fall archery hunting season. The highest number of turkeys harvested during the hunting seasons from 2006 to 2012 occurred in 2006

when 234 turkeys were harvested in the State during the spring season. There has been a steady decrease in annual turkey harvest in Rhode Island since 2006. In 2011 and 2012, 155 and 109 turkeys were harvested during the fall and spring seasons, respectively, which represent decreases of 33.8% and 53.4% from the 2006 harvest. Harvest declines from 2010 to 2012 follow poor brood production observed during annual summer brood surveys during 2006 to 2009, which resulted in lower young per adult ratios (Tefft 2012). The 2010 and 2011 summer brood surveys recorded increased production indexes, 4.0 and 4.1 young per adult, respectively, above the ten-year average of 3.5, resulting in positive growth and some recovery in the statewide population, which had declined over the previous four years (Tefft 2012).

Requests for assistance received by the WS program in Rhode Island 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 own reflection as another turkey and attempt to attack the image, which can scratch paint on vehicles and siding on houses. Between FY 2006 and FY 2012, WS has dispersed 57 turkeys to manage damage or threats of damage occurring within the State, when requested. In addition, WS has also employed lethal methods to take 38 wild turkeys in the State between FY 2006 and FY 2012. 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 4.5 – Number of Eastern wild turkeys addressed and turkey harvest from 2006 to 2012 in Rhode Island

Year	Dispersed by WS[1]	WS' Take[1]	Hunter Harvest		Total
			Fall[2]	Spring[2]	
2006	0	0	N/A[†]	234	**234**
2007	0	0	N/A	194	**194**
2008	2	0	N/A	203	**203**
2009	3	1	N/A	206	**207**
2010	1	1	N/A	163	**164**
2011	15	5	4	151	**160**
2012	36	31	5	104	**140**
Total	**57**	**38**	**9**	**1,255**	**1,302**

[1]Data reported by federal fiscal year
[2]Rhode Island turkey seasons occur during the fall and spring each year. The fall season of the previous year and the spring season correlate with the federal fiscal year, for example the 2011 fall turkey season and the spring 2012 turkey seasons occurred in FY 2012.
[†]N/A=data is available; data is not available because no fall season existed during these years.

Based on previous requests for assistance and in anticipation of additional efforts, WS could lethally take up to 50 wild turkeys annually under the proposed action alternative. Based on the statewide population estimate of 4,000 turkeys, take of up to 50 turkeys by WS would represent 1.3% of the estimated statewide population if the population in the State remains at least stable. If WS had lethally taken 50 turkeys in FY 2012, the take would have represented 45.9% of the number of turkeys harvested in the State during the 2011 fall season and the 2012 spring season, which was the lowest harvest level in the State between the 2006 season and the 2012 spring season. The take of wild turkeys in the State by WS would only occur at levels permitted by the RIDEM, which regulates the take of wild turkeys in the State.

As state previously, most requests received previously by WS in the State were associated with threats associated with turkeys at airports, which are restricted areas and hunting is not permitted. The take of turkeys by WS would not reach a magnitude where the ability to harvest turkeys in the State during the

regulated seasons would be affected, based on the areas where requests for assistance are likely to occur and the low magnitude of take compared to the estimated statewide population.

Double-Crested Cormorant Biology and Population Impacts Analysis

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

The double-crested cormorant is one of six species of cormorants breeding in North America and has the widest range (Hatch 1995). Double-crested cormorants range throughout North America, from the Atlantic coast to the Pacific coast (USFWS 2003). The population (breeding and non-breeding birds) in the United States was estimated to be greater than 1 million birds in the 1990s (Tyson et al. 1999). The USFWS estimated the global population at approximately 2.2 million cormorants, 90% of the global population occurred in North America (USFWS 2003). Tyson et al. (1999) found that the cormorant population increased about 2.6% annually during the early 1990s. The greatest increase was in the Interior region, which was the result of a 22% annual increase in the number of cormorants in Ontario and those states in the United States bordering the Great Lakes (Tyson et al. 1999). From the early 1970s to the early 1990s, the Atlantic population of cormorants increased from about 25,000 pairs to 96,000 pairs (Hatch 1995). While the number of cormorants in this region declined by 6.5% in the early to mid-1990s, some populations were still increasing during this period (Tyson et al. 1999). The number of breeding pairs of cormorants in the Atlantic and Interior population was estimated at over 85,510 and 256,212 nesting pairs, respectively (Tyson et al. 1999).

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

Double-crested cormorants have only recently become common in Rhode Island. Before 1981, there were no nesting birds in the State, and they were only sighted migrating to and from their southern wintering grounds. Since 1981, year round double-crested cormorant populations have been on the rise. The nesting population increased rapidly from 1,768 nests in 1992 to 2,058 nests in 1997 (Environmental Data Center 2008).

When cormorants nest in trees on isolated coastal islands, their droppings (guano) can destroy the leaves and eventually kill off the trees in the nesting colonies. Some small islands on Narragansett Bay have been almost completely defoliated by double-crested cormorant guano (Environmental Data Center 2008).

Drury (1973, 1974) reported 35 cormorants off Sakonnet Point, Rhode Island that appeared to be nesting but the observation was not confirmed and this site was later reported as newly occupied in 1981. Data

from the BBS indicates that double-crested cormorant populations in the Eastern BBS Region and New England/Mid-Atlantic Region have increased annually at rates of 3.6% and 12.0%, respectively, from 1966 through 2011 (Sauer et al. 2012). There is no BBS trend data for double-crested cormorants available for Rhode Island.

Along with the increase in breeding birds, in the 1980s, the species became regular in winter along the coast and inland during migration (Zeranski and Baptist 1990, Sibley 1994). Data from the CBC conducted from 1971, the first year cormorants were recorded, through 2011 shows an average of 49 cormorants have been observed in areas surveyed ranging from a low of zero to a high of 361 cormorants in 2006 (NAS 2010). During this period, the total number of cormorants observed during the CBC has shown an increasing trend, while observations per party hour have shown a slight decline. The double-crested cormorant is ranked as a species of lowest concern by the Mid-Atlantic/New England/Maritimes Regional Waterbird Conservation Plan (MANEM Waterbird Conservation Plan 2006) and as a species of least concern by BirdLife International (2012).

To address cormorant damage to aquaculture resources and other resources, the USFWS, in cooperation with WS, prepared a FEIS that evaluated alternative strategies to managing cormorant populations in the United States (USFWS 2003). The selected alternative in the FEIS modified the existing AQDO and established a PRDO that allow for the take of cormorants without a depredation permit when cormorants are committing or about to commit damage to those resource types. The modified AQDO allows cormorants to be taken in 13 States without a depredation permit to reduce depredation on aquaculture stock at private fish farms and state and federal fish hatcheries but does not include aquaculture facilities in Rhode Island (see 50 CFR 21.47). The PRDO allows for the take of cormorants without a depredation permit in 24 states when those cormorants cause or pose a risk of adverse effects to public resources (*e.g.*, fish, wildlife, plants, and their habitats) but does not include public resources in Rhode Island (see 50 CFR 21.48). All take of cormorants in Rhode Island to alleviate damage or the threat of damage requires a depredation permit issued by the USFWS.

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

The take of cormorants from 2004 through 2011 under the depredation orders and under depredation permits in the 24 States included in the PRDO are shown in Table 4.6. Between 2004 and 2011, an average of 40,844 cormorants have been taken under the two depredation orders (PRDO and AQDO) and under depredation permits issued by the USFWS in those 24 States authorized to take cormorants. The USFWS (2009) estimated the take of cormorants under the depredation orders and depredation permits involved primarily those cormorants that were considered a part of the Interior cormorant population. Those cormorants found in Rhode Island are considered part of the Atlantic population of cormorants (Tyson et al. 1999).

As shown in Table 4.6, the annual take of cormorants from 2004 through 2011 has not exceeded 159,635 cormorants in any given year. The highest level of cormorant take occurred in 2006 when 54,045 cormorants were lethally taken, which represents 34.3% of the 159,635 cormorants evaluated in the

cormorant management FEIS. The FEIS determined an annual take of 159,635 cormorants would be sustainable at the State, regional, and national level (USFWS 2003, USFWS 2009). The take that has occurred since the implementation of the preferred alternative in the FEIS that created a PRDO and modified the existing AQDO, has only reached a high of 34.3% of the level evaluated in the FEIS, which determined the higher level of take would be sustainable at the State, regional, and national level. Upon further evaluation, the USFWS determined the implementation of the preferred alternative in the FEIS that has allowed the annual take level of cormorants under the PRDO, the AQDO, and under depredation permits had not reached a level where undesired adverse effects to cormorant populations would occur (USFWS 2009). The USFWS subsequently extended the expiration dates of the PRDO and the current AQDO (USFWS 2009).

Table 4.6 – Double-crested cormorant take in the 24 States included in the PRDO*

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

*preliminary take data provided by the USFWS
†N/A=data is currently unavailable

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

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

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

Between 2006 and 2012, the USFWS has authorized the lethal to of up to 130 cormorants by other entities within the State, with the highest authorized level occurring from 2009 through 2012 when the USFWS permitted the lethal removal of 30 cormorants per year (see Table 4.7). Between FY 2006 and FY 2012, 31 cormorants have been lethally taken by WS in the State. The highest level of take level occurred during FY 2012 when 11 cormorants were lethally removed pursuant to depredation permits. In addition, WS has employed non-lethal methods to disperse 414 cormorants in the State to alleviate damage between FY 2006 and FY 2012.

Table 4.7 – Double-crested cormorants addressed in Rhode Island from 2006 to 2012

Year	Dispersed by WS[1]	Take Under Depredation Permit			
		WS' Take[1]	Non-WS' Take Authorized	Non-WS' Take[2]	Total Take by All Entities
2006	82	3	5	0	3
2007	77	2	5	0	2
2008	17	2	0	0	2
2009	50	5	30	0	5
2010	107	4	30	3	7
2011	54	4	30	3	7
2012	27	11	30	N/A†	11
TOTAL	**414**	**31**	**130**	**6**	**37**

[1]Data reported by federal fiscal year
[2]Data reported by calendar year
† N/A=information not currently available; data reports for 2012 are currently incomplete

Although only limited cormorant damage management activities have been conducted by WS in Rhode Island, WS anticipates the number of requests for assistance to manage damage caused by cormorants will increase based on the increasing number of cormorants observed in the State during the breeding season and overwintering within the State. If an increase in the number of requests for assistance occurs, under the proposed action, the number of cormorants lethally taken annually by WS would also likely increase to address those requests for assistance, likely to address threats occurring to aviation safety, natural resources, and aquaculture. Threats to aviation could occur at coastal airports or at airports with water bodies on or adjacent to the airfield. These threats would increase if a cormorant nesting colony were to form near an airport. Threats to natural resources could occur if cormorants were competing with other colonial waterbirds for nest sites and feeding on wild freshwater and anadromous fish stocks. Threats to aquaculture could occur if cormorants were feeding on finfish at hatcheries or commercial aquaculture facilities. Based on increasing trends in the number of cormorants in the State observed during the development of this EA, WS anticipates that up to 100 cormorants could be lethally taken by WS annually and up to 50 cormorant nests with eggs could be removed and destroyed annually to alleviate damage under depredation permits.

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

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

WS' proposed take of up to 100 cormorants and up to 50 cormorant nests annually to address damage and threats fall within the parameters of take evaluated within the cormorant management FEIS (USFWS 2003, USFWS 2009). If WS' anticipated take of up to 100 cormorants were included with the average take by all entities from 2007 through 2011, the combined take would be below the level of take analyzed in the FEIS. Although the USFWS could issue depredation permits to other entities in the State, when the permitting of the take occurs within the impacts parameters of the cormorant population management FEIS (USFWS 2003, USFWS 2009), the cumulative take of cormorants in the State would not reach a level where undesired declines would occur.

Great Blue Heron Biology and Population Impacts Analysis

The head of the great blue heron is largely white with dark under parts and the body is primarily bluish in color. Great blue herons are a common widespread wading bird that can be found throughout most of North America and can be found year-around in most of the United States, including Rhode Island (Butler 1992). Great blue herons are most often located in freshwater and brackish marshes, lakes, rivers, and lagoons (MANEM Waterbird Conservation Plan 2006). Herons are known to nest in trees, rock ledges, and coastal cliffs and may travel up to 30 km to forage with a mean forage distance of 2.6 to 6.5 km (MANEM Waterbird Conservation Plan 2006). Great blue herons feed mainly on fish but cormorants are also known to capture invertebrates, amphibians, reptiles, birds, and mammals (Butler 1992).

Most nesting great blue heron colonies in the northeastern United States occur along the coastal areas located in BCR 14 and BCR 30. Rhode Island lies entirely within BCR 30. In BCR 14, the breeding population has been estimated at 12,000 herons while the breeding population in BCR 30 has been estimated at nearly 31,000 herons (MANEM Waterbird Conservation Plan 2006). The breeding populations of great blue herons in BCR 14 and BCR 30 have been given a conservation ranking of lowest concern (MANEM Waterbird Conservation Plan 2006). Between 1966 and 2011, the number of herons observed along routes surveyed in BCR 14 during the BBS has shown an increasing trend estimated at 0.2% annually, with a 1.1% annual increase occurring from 2001 through 2011 (Sauer et al. 2012). In BCR 30, the number of herons observed in areas surveyed during the BBS has shown an increasing trend estimated at 2.6% annually between 1966 and 2011, with a 2.4% annual increasing occurring from 2001 through 2011 (Sauer et al. 2012).

Great blue herons are showing a statistically significant increase across all survey routes of the BBS. Since 1966, the number of great blue herons observed survey-wide has increased at an annual rate of 0.8%, with a 1.6% annual increase occurring from 2001 through 2011 (Sauer et al. 2012). However, there is currently no BBS data for great blue herons in Rhode Island (Sauer et al. 2012). The total number of great blue herons and number of herons per party hour observed during the CBC have shown increasing trends in Rhode Island from 1966 to 2011. Total observations have increased from a low of 24 birds observed in 1967 in Rhode Island to a high of 206 individuals in 2007, averaging 86 herons annually (NAS 2010).

In 2006, the breeding population of great blue herons was estimated at 42,232 breeding pairs or 84,464 adult herons in the northeastern United States, with 30,570 pairs occurring in BCR 30 (MANEM Waterbird Conservation Plan 2006). The overall population objective for herons in the northeastern United States is to maintain current population levels (MANEM Waterbird Conservation Plan 2006). In BCR 14, the breeding population of great blue herons was estimated at 11,662 breeding pairs in 2006 with the breeding population trend in the MANEM showing a "*large increase*" (MANEM Waterbird Conservation Plan 2006). In BCR 14 and BCR 30, which likely represents the herons that would be present in Rhode Island, the MANEM Waterbird Conservation Plan (2006) placed the great blue heron population in the conservation status category of lowest concern. BirdLife International (2012) ranks the great blue heron as a species of least concern.

Great blue herons are listed as a species of concern by the RIDEM; however, birds are listed based on the status of breeding populations in Rhode Island. Migratory bird species that are state, but not federally, listed may be lethally taken legally in Rhode Island under USFWS depredation permits approved and co-signed by the RIDEM.

To alleviate threats to aviation safety, WS has lethally taken nine great blue herons in Rhode Island, averaging less than 1.3 per year, from FY 2006 through FY 2012. WS has also employed non-lethal methods to disperse 52 herons in Rhode Island from FY 2006 to FY 2012. In addition to the take of herons by WS to alleviate damage or threats, the USFWS has issued depredation permits, co-signed by the RIDEM, to other entities for the take of herons. As shown in Table 4.8, the USFWS has authorized the lethal removal of 10 herons annually by other entities from 2006 through 2012.

Table 4.8 – Number of great blue herons addressed in Rhode Island from 2006 to 2012

Year	Dispersed by WS[1]	Take under Depredation Permits			
		WS' Take[1]	Non-WS' Take Authorized	Non-WS' Take[2]	Total Take by All Entities[2]
2006	7	2	10	0	2
2007	2	0	10	0	0
2008	7	0	10	0	0
2009	5	2	10	0	2
2010	12	0	10	2	2
2011	8	1	10	0	1
2012	11	4	10	N/A[†]	4
TOTAL	**52**	**9**	**70**	**2**	**11**

[1]Data reported by federal fiscal year
[2]Data reported by calendar year
[†] N/A=information not currently available; data reports for 2012 are currently incomplete

To address requests for assistance to manage damage associated with great blue herons in the future, up to 20 herons could be lethally taken annually by WS to alleviate damage and threats. Of these, no more than

five herons would be taken during the nesting season, March through June. The increased level of take analyzed when compared to the take occurring by WS from FY 2006 through FY 2012 would be in anticipation of additional efforts to address damage. Additional efforts could occur from requests to address threats of aircraft strikes at airports, to reduce damage to natural resources, such as nest site competition between herons and other colonial nesting waterbirds, and to manage predation at fish hatcheries and aquaculture facilities. If the USFWS continued to authorize the lethal removal of up to 10 herons annually by other entities, the combined WS' take and take by other entities would total 30 herons. Take of up to 30 herons by all entities within the State would represent less than 0.1% of the breeding population estimated in BCR 30, including Rhode Island.

The number of great blue herons present in Rhode Island at any given time likely fluctuates throughout the year. No breeding or wintering population estimates are available for great blue herons in Rhode Island. Given the increasing population trends observed for herons in Rhode Island, the limited take proposed by WS when compared to the estimated breeding populations in BCR 30 and BCR 14, the magnitude of WS' estimated take could be considered low. The permitting of the take by the USFWS and the RIDEM would also ensure the cumulative take of herons in New England and the Mid-Atlantic, including the take proposed by WS in Rhode Island under this assessment, would not reach a magnitude where undesired adverse effects would occur. The take of herons by WS would occur within allowed levels of take permitted by the USFWS and the RIDEM.

Black-crowned Night-heron Biology and Population Impacts Analysis

With a range that spans five continents, including much of North America, the black-crowned night-heron is the most widespread heron in the world. It is most active at dusk and at night, feeding in the same areas that other heron species frequent during the day.

The black-crowned night-heron is a medium sized, stocky heron with a short neck and thick bill. As the name implies, the head and back of the adult black-crowned night-heron are black, the wings are gray and the neck and under parts are gray to white. Adult black-crowned night-herons have 2 to 3 long, white feathers on the head used in courtship, a black bill and red eyes. Juveniles are a brown to gray with white spots on the wings and light streaking below, with yellow bills and orange eyes. They are the most widespread species of heron in the world, ranging across North and South America, Asia, Europe, and Africa (Hothem et al. 2010).

A wide variety of wetland habitats are used by night-herons, including marshes, swamps, ponds, lakes, grassy salt marsh. Night-herons nest in trees in wooded areas near water or on the ground on islands and forages in shallow, weedy pond margins, creeks, marshes, mudflats, tidal creeks, ditches, and around pilings (MANEM Waterbird Conservation Plan 2006). Black-crowned night-herons feed mainly on small fish, crustaceans, frogs, aquatic insects, small mammals and small birds. These birds stand still at the water's edge and wait to ambush prey, mainly at night or early morning.

From 1966 to 2011, the number of black-crowned night-herons observed across all routes surveyed in the Eastern BBS region has declined annually estimated at -1.2%; however, from 2001 through 2011, the number of night-herons observed in areas surveyed has shown an increasing trend estimated at 1.8% annually (Sauer et al. 2012). A similar trend has occurred across all routes surveyed during the BBS in the New England/Mid-Atlantic Coast Region. From 1966 through 2011, the number of night herons observed in areas during the BBS in the New England/Mid-Atlantic Coast Region has declined at an estimated rate of -1.3% annually; however, from 2001 through 2011, the number observed has increased at an estimated rate of 0.4% annually (Sauer et al. 2012). There is no BBS trend data for black-crowned night-herons available for Rhode Island. The number and number per party hour of black-crowned night-

herons observed overwintering in Rhode Island have shown a decreasing trend from 1966 to 2011 (NAS 2010). Total observations have averaged four night herons annually (NAS 2010).

In 2006, the breeding population of black-crowned night-herons was estimated at 10,388 pairs in BCR 30, which comprises all of Rhode Island, and 2,468 pairs in neighboring BCR 14 (MANEM Waterbird Conservation Plan 2006). The current population of black-crowned night-herons is unknown in Rhode Island. The Mid-Atlantic/New England/Maritimes Regional Waterbird Conservation Plan ranks the black-crowned nigh-heron as a species of moderate concern (MANEM Waterbird Conservation Plan 2006) and BirdLife International (2012) ranks the black-crowned night-heron as a species of least concern.

To alleviate threats to aviation safety, WS has lethally taken one black-crowned night-heron in Rhode Island from FY 2006 through FY 2012. WS has also employed non-lethal methods to disperse 30 night-herons in Rhode Island from FY 2006 to FY 2012. The USFWS did not authorize other entities to lethally remove night-herons in the State between 2006 and 2012.

To address requests for assistance to manage damage and threats associated with black-crowned night-herons in the future, up to 20 black-crowned night-herons could be lethally taken annually by WS to alleviate damage and threats. The increased level of take analyzed when compared to the take occurring by WS from FY 2006 through FY 2012 would be in anticipation of requests to address threats to T&E species, threats of aircraft strikes at airport, and predation at fish hatcheries and aquaculture facilities.

The number of black-crowned night-herons present in Rhode Island at any given time likely fluctuates throughout the year. No breeding trends or estimates are available for black-crowned night herons in Rhode Island and the wintering population in Rhode Island shows a declining trend (NAS 2010). The permitting of the take by the USFWS and the RIDEM ensures the cumulative take of herons in New England and the Mid-Atlantic, including the take proposed by WS in Rhode Island under this assessment, would not reach a magnitude where undesired adverse effects would occur. The take of herons by WS would occur within allowed levels of take permitted by the USFWS and the RIDEM.

Black Vulture Biology and Population Impacts Analysis

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

According to the Birding in Rhode Island Checklist (2011), black vultures are considered uncommon and have not yet been recorded nesting in the State. No BBS trend data is currently available for black vultures in Rhode Island. However, BBS trend data for black vultures observed in the Eastern BBS Region and the New England/Mid-Atlantic Region have increased at annual rates of 3.4% and 8.2%, respectively, from 1966 through 2011 (Sauer et al. 2012). The number and number per party hour of black vultures observed overwintering in Rhode Island have shown steadily increasing trends from 1999, the first year the species was reported in CBC surveys in Rhode Island, to 2011 (NAS 2010). Since 1999, CBC observations of black vultures have ranged from a low of zero in several years to a high of 18 in 2002 and 2004. BirdLife International (2012) ranks the black vulture as a species of least concern.

Reports of the species in the State have been increasing and non-lethal control efforts by WS in neighboring Connecticut have been increasing (T. Cozine, WS personal observation 2012). The USFWS authorized the lethal removal of up to 100 black vultures by other entities in 2006. However, there has been no WS or non-WS take of black vultures reported to the USFWS under depredation permits in Rhode Island from 2006 to 2011. Additionally, no black vultures have been non-lethally dispersed by WS in the State during this period.

Based on the increasing need to address damage associated with black vultures in the State and the potential for a population increase as black vultures expand their range (Wilbur 1983, Rabenhold and Decker 1989), WS could lethally take up to 25 black vultures under the proposed action to address damage and threats associated with black vultures.

Similar to the other native migratory bird species addressed in this assessment, the take of black vultures can only occur when authorized through the issuance of depredation permits by the USFWS that are co-signed by the RIDEM. The permitting of the take would ensure the cumulative take of black vultures annually would occur within allowable take levels to achieve desired population objectives for the species. Therefore, the take of vultures by WS would only occur at levels permitted by the USFWS and the RIDEM through the issuance of depredation permits.

Turkey Vulture Biology and Population Impacts Analysis

Turkey vultures can be found throughout Mexico, across most of the United States, and along the southern tier of Canada (Wilbur 1983, Rabenhold and Decker 1989). Turkey vultures can be found throughout the year in Rhode Island (Kirk and Mossman 1998). Turkey vultures can be found in virtually all habitats but are most abundant where forested areas are interrupted by open land (Brauning 1992). Turkey vultures nest on the ground in thickets, stumps, hollow logs, or abandoned buildings (Walsh et al. 1999). Turkey vultures often roost in large groups near homes or other buildings where they can cause property damage from droppings or by pulling and tearing shingles or rubber roofing material. Turkey vultures prefer carrion but will eat virtually anything, including insects, fish, tadpoles, decayed fruit, pumpkins, and recently hatched heron and ibis chicks (Brauning 1992). Turkey vultures have been reported to live up to 16 years of age (Henny 1990).

BBS trend data for turkey vultures observed in the Eastern BBS Region and the New England/Mid-Atlantic Region have increased at annual rates of 3.5% and 3.8%, respectively, from 1966 through 2011 (Sauer et al. 2012). No BBS trend data is currently available for turkey vultures in Rhode Island. The statewide population of turkey vultures is currently unknown but has been estimated at 40 turkey vultures based on BBS data (Rich et al. 2004). However, the population is probably much higher than this as BBS surveys are not well designed for monitoring vulture populations as discussed in the previous section on black vultures.

The population estimates provided by Rich et al. (2004) for some species are often poor due to high variance on BBS counts, low sample size, or due to other species-specific limitations of BBS methods. The population estimates published by Rich et al. (2004) were derived from BBS data for individual species. BBS data is derived from surveyors identifying bird species based on visual and auditory cues at stationary points along roadways. Vultures produce very few auditory cues that would allow for identification (Buckley 1999) and thus, surveying for vultures is reliant upon visual identification. For visual identification to occur during surveys vultures must be either flying or visible while roosting. Coleman and Fraser (1989) estimated that vultures spend 12 to 33% of the day in summer and 9 to 27% of the day in winter flying. Avery et al. (2011) found that turkey vultures were most active in the winter (January to March) and least active during the summer (July to September). Avery et al. (2011) found that across all months of the year, turkey vultures were in flight 18.9% of the daylight hours.

Most vultures during surveys are counted while flying since counting at roosts can be difficult due to obstructions limiting sight and due to the constraints of boundaries used during the surveys, especially the BBS since observers are limited to counting only those bird species within a quarter mile of a survey point. Bunn et al. (1995) reported vulture activity increased from morning to afternoon as temperatures increased. Avery et al. (2011) found turkey vulture flight activity peaked during the middle of the day. Three hours after sunrise, Avery et al. (2011) found only 10% of turkey vultures in flight. Therefore, surveys for vultures should occur later in the day to increase the likelihood of vultures being observed by surveyors.

Observations conducted for the BBS are initiated in the morning since mornings tend to be periods of high bird activity. Because vulture activity tends to increase from morning to afternoon when the air warms and vultures can find thermals for soaring, vultures are probably under-represented in BBS data. The limitations associated with surveying for vultures under current BBS guidelines is the likely cause of the poor data quality ratings assigned by Rich et al. (2004) for the population estimate of turkey vultures in Rhode Island. Given the limitations of current survey protocols, populations of vultures in Rhode Island are likely higher than currently derived from survey data. As an example, Rich et al. (2004) estimated the black vulture population in Virginia at 5,000 vultures using BBS data. In comparison, Runge et al. (2009) estimated that there were over 91,000 black vultures in Virginia during 2006 using other biological models.

The number and number per party hour of turkey vultures observed overwintering in Rhode Island has shown a steady increasing trend from 1984, the first year the species was reported in CBC surveys in Rhode Island, to 2011 (NAS 2010). CBC observations of turkey vultures have ranged from a low of zero in the 1980s to a high of 142 in 2004. BirdLife International (2012) ranks the turkey vulture as a species of least concern.

The take of turkey vultures is also prohibited under the MBTA except through the issuance of depredation permits issued by the USFWS. The number of turkey vultures addressed in Rhode Island by all entities to alleviate damage is shown in Table 4.9. From FY 2006 through FY 2012, the WS program in Rhode Island has lethally removed eight turkey vultures in the State and employed non-lethal methods to disperse 2,034 vultures to alleviate damage. No turkey vultures have been lethally taken from 2006 through 2011 by non-WS entities in the State pursuant to depredation permits issued by the USFWS and the RIDEM. From FY 2006 through FY 2012, an average of over 1.1 turkey vultures has been lethally taken in the State by WS to alleviate damage pursuant to depredation permits.

The number of requests for WS assistance to alleviate damage associated with turkey vultures has increased in Rhode Island from FY 2006 to FY 2012. Based on an anticipated increasing population trend for turkey vultures in the State, the number of requests for assistance with managing damage associated with turkey vultures and the number of vultures that will be addressed to meet those requests is likely to increase. Therefore, based on previous requests for assistance and in anticipation of an increasing number of requests and the subsequent need to address more vultures, up to 25 turkey vultures could be lethally taken annually by WS to alleviate damage and threats.

If up to 25 turkey vultures were taken annually by WS, WS' take would represent 62.5% of the estimated statewide population of turkey vultures estimated at 40 vultures if the population remains at least stable. It should be noted that WS believes this estimate to be extremely low because WS personnel have observed individual roost sites in Rhode Island with more than 40 turkey vultures (T. Cozine, WS, personal observation 2003) and approximately 100 feeding at a landfill during summer months (K. McLellan, WS, personal observation 2012). The permitting of the take by the USFWS and the RIDEM

pursuant to the MBTA ensures take by WS and by other entities occurs within allowable take levels to achieve the desired population objectives for turkey vultures in the State.

Table 4.9 – Number of turkey vultures addressed in Rhode Island from FY 2006 to FY 2011

Year	Dispersed by WS[1]	Take under Depredation Permits			
		WS' Take[1]	Non-WS' Take Authorized	Non-WS' Take[2]	Total Take by All Entities[2]
2006	2	0	110	0	0
2007	0	0	10	0	0
2008	0	0	10	0	0
2009	1	2	10	0	2
2010	7	1	10	0	1
2011	4	1	10	2	3
2012	2,020	4	10	N/A[†]	4
TOTAL	**2,034**	**8**	**170**	**2**	**10**

[1]Data reported by federal fiscal year
[2]Data reported by calendar year
[†] N/A=information not currently available; data reports for 2012 are currently incomplete

Osprey Biology and Population Impacts Analysis

Ospreys are large raptors most often associated with shallow aquatic habitats where they feed primarily on fish (Poole et al. 2002). Historically, nests of osprey were constructed on tall trees and rocky cliffs. Today, ospreys are most commonly found nesting on man-made structures such of power poles, cell towers, and man-made nesting platforms (Poole et al. 2002). Osprey can be located throughout the year along the coastal areas of the State with breeding populations also occurring further inland (Poole et al. 2002).

Requests for assistance received by WS to alleviate damage or the threat of damage associated with osprey involved threats to aircraft from strikes and were associated with nesting behavior. Osprey nests are often constructed of large sticks, twigs, and other building materials that can cause damage and prevent access to critical areas when those nests are built on man-made structures (*e.g.*, power lines, cell towers, boats). Disruptions in the electrical power supply can occur when nests are located on utility structures and can inhibit access to utility structures for maintenance by creating obstacles to workers. For example, the average size of an osprey nest in Corvallis, Oregon was 41-inches in diameter and weighed 264 pounds (United States Geological Survey 2005). In 2001, 74% of occupied osprey nests along the Willamette River in Oregon occurred on power pole sites (United States Geological Survey 2005).

WS has responded to requests for assistance involving osprey previously by providing technical assistance and by providing direct operational assistance using nest and egg removal and destruction and non-lethal harassment methods to disperse osprey. Between FY 2006 and FY 2012, the WS program in Rhode Island addressed one osprey nest, with one egg. This nest was located on the chimney of a private residential building and made it impossible for the residents to utilize their home heating furnace and hot water heater due to the risk of fire and carbon monoxide poisoning because the nest completely blocked the chimney flue. Also during this period, WS addressed 103 ospreys using non-lethal harassment methods and lethally removed eight ospreys on airports to alleviate threats to aviation safety. All eight ospreys were taken by WS during FY 2012. The USFWS did not authorize take of osprey or active osprey nests by non-WS entities from 2006 to 2011 and no osprey or osprey nests were reported lethally taken or destroyed by non-WS entities during this period.

Under the proposed action alternative, WS could be requested to use lethal methods to remove osprey when non-lethal methods were ineffective or were determined to be inappropriate using WS Decision model. An example could include osprey that pose an immediate strike threat at an airport where attempts to disperse the osprey were ineffective. WS would continue to employ primarily non-lethal methods to address requests for assistance with managing damage or threats of damage associated with osprey in the State. Based on previous requests for assistance to manage damage associated with osprey and in anticipation of additional efforts, WS could lethally take up to 10 ospreys and destroy up to five active osprey nests annually in the State to alleviate damage. Ospreys are listed as a species of concern by the RIDEM based on the status of breeding population in Rhode Island. As previously stated, migratory bird species that are state, but not federally, listed may be lethally taken legally in Rhode Island under USFWS depredation permits approved and co-signed by RIDEM. Because many of the conflicts caused by osprey involve nesting activity, all of this take could occur during the nesting season.

From 1966 to 2011, the number of osprey observed along routes surveyed in the Eastern BBS Region and New England/Mid-Atlantic Region during the BBS has shown increasing trends estimated at 3.4% and 6.9% annually, respectively (Sauer et al. 2012). No BBS trend estimates are available for osprey in Rhode Island. The number and number per party hour of osprey observed in areas surveyed during the CBC have shown slight decreasing trends in the State since 1975, the first year osprey were reported in the CBC surveys, to 2011 (NAS 2010). Based on BBS data, Rich et al. (2004) estimated the statewide population of osprey was 140 birds. BirdLife International (2012) ranks the osprey as a species of least concern.

Based on a statewide population estimated at 140 osprey and if up to 10 osprey were taken in any given year, WS' take would represent 7.1% of the estimated population if the population remains at least stable. A population of 140 ospreys would represent approximately 70 breeding pairs, WS' removal and destruction of up to five osprey nests with eggs would represent 7.1% of the annual nesting activity, if the breeding pairs do not relocate and nest in another location. The take of osprey and active osprey nests by WS would only occur when permitted and only at levels authorized on depredation permits issued by the USFWS and the RIDEM.

Bald Eagle Biology and Population Impact Analysis

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). The bald eagle has been the national emblem of the United States since 1782 and has been a key symbol for Native Americans (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 opportunistic feeders with a varied diet that consists of mammalian, avian, and reptilian prey; however, eagles are most fond of fish (Buehler 2000). Buehler (2000) describes food acquisition by eagles as "[An eagle] *often scavenges prey items when available, pirates food from other species when it can, and captures its own prey only as a last resort*". 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. Eggs are generally 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). Nests of bald eagles occur primarily near the crown of trees with typical nests ranging in size from 1.5 to 1.8 meters in diameter and 0.7 to 1.2 meters tall (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 1.6). 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 "*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 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 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.

As was discussed in Chapter 1, under the Bald and Golden Eagle Protection Act, the definition of "*take*" includes actions that can "*molest"* or *"disturb"* eagles. For the purposes of the Act under 50 CFR 22.3, the term "*disturb"* as it relates to take has been defined as "*to agitate or bother a bald……eagle to a degree that causes, or is likely to cause, based on the best scientific information available, 1) injury to an eagle, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior."*

The 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 USC 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 2010). 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 in the State. 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 22.26, WS and/or an airport authority could apply for a permit allowing for the harassment of 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 were issued by the USFWS to harass eagles that are posing a threat of aircraft strikes, no activities would be conducted by WS. Activities would 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. No lethal take of eagles would occur under this proposed action alternative.

WS would 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 affect the human environment when permits are issued for "*take*" of eagles under the guidelines allowed within the Act (USFWS 2010). 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 2010).

Red-shouldered Hawk Biology and Population Impact Analysis

Red-shouldered are a common forest-dwelling hawk of the East and California, and favors woodlands near water. It is perhaps the most vocal American hawk. It is a medium to large hawk. Adults have black and white striped wings and tail and barred reddish and white underparts and may have reddish markings on the wings that give the species its name. They also display a pale crescent near wingtips in flight. In the eastern United States and Canada juvenile red-shouldered hawks are streaked brown and white on the underside, are brown above, and have a tail with dark and light brown bands, while the wing crescents seen in flight is tawny (Dykstra et al. 2008).

The nest is a large bowl of sticks, dried leaves, Spanish moss, lichens, strips of bark, and fresh conifer twigs, which is lined with fine bark, mosses, lichens, and conifer twigs. The nest is placed in main crotch of tree (Dykstra et al. 2008). Egg laying in red-shouldered hawks occurs from late-March through early-May with April being the primary period when eggs are laid (Dykstra et al. 2008). Nestlings can be found from late-April through late July with the peak occurring from early-May through late-June (Dykstra et al. 2008). The number of eggs laid by red-shouldered hawks ranges from 2 to 5 eggs with averages of 3 to 4 eggs in most of the eastern portion of their range (Dykstra et al. 2008). Replacement clutches are known to occur if the first clutch is destroyed (Palmer 1988).

Requests for assistance with red-shouldered hawks received by WS are usually associated with threats to human safety or human injury associated with nesting behavior, but may also involve threats to aircraft from strikes. Some requests for assistance may also involve real or perceived threats to household pets or livestock such as poultry posed by red-shouldered hawks that may involve nest aggression or predation.

WS has responded to requests for assistance involving red-shouldered hawks attacking people, including children, in neighboring Connecticut by providing technical assistance and by providing direct operational assistance using nest and egg removal and destruction, harassment methods to disperse red-shouldered hawk, and live capture and transport to licensed raptor rehabilitators. Between FY 2006 and FY 2012, the WS program in Rhode Island addressed two red-shouldered hawks through non-lethal harassment to reduce threats to aviation safety. The USFWS did not authorize any take of red-shouldered hawks or active red-shouldered hawk nests, with eggs, by any non-WS entities under depredation permits from 2006 to 2011 and none were reported lethally taken or destroyed.

Under the proposed action alternative, WS could be requested to use lethal methods to remove red-shouldered hawk when non-lethal harassment methods were ineffective or were determined to be inappropriate for eliminating threats to human health and safety, damage or threats of damage using WS Decision model. Examples could include taking one of a pair of red-shouldered hawks where nest and egg destruction was previously used but did not result in the desired outcome of the hawks relocating to a safe nesting site or removal of a red-shouldered hawk that posed an immediate strike threat at an airport where attempts to disperse the red-shouldered hawk were ineffective. WS could also live capture

dangerous or threatening red-shouldered hawks or juvenile hawks and transport them to licensed raptor rehabilitators, falconers, or zoos for temporary or permanent captivity.

WS would continue to employ primarily non-lethal methods to address requests for assistance with managing damage or threats of damage associated with red-shouldered hawk in the State. Based on previous requests for assistance to manage damage associated with red-shouldered hawk and in anticipation of receiving an increasing number of requests for assistance, WS could lethally take up to six red-shouldered hawks and destroy up to three red-shouldered hawk nests with eggs annually in the State to alleviate damage.

From 1966 to 2011, the number of red-shouldered hawk observed along routes surveyed in the Eastern BBS Regions, New England/Mid-Atlantic Region, and Rhode Island during the BBS has shown increasing trends estimated at 2.6%, 2.7%, and 7.3% annually, respectively (Sauer et al. 2012). The number red-shouldered hawks and the number observed per party hour in areas surveyed during the CBC have shown increasing trends in the State from 1966 to 2011 (NAS 2010). Based on BBS data, Rich et al. (2004) estimated the statewide breeding population of red-shouldered hawk at 190 birds. BirdLife International (2012) ranks the red-shouldered hawk as a species of least concern.

Based on a statewide population estimated at 190 red-shouldered hawk and if up to six red-shouldered hawk were taken in any given year, WS' take would represent 3.2% of the estimated breeding population if the population remained at least stable. A population of 190 red-shouldered hawks would represent approximately 95 breeding pairs, WS' removal and destruction of up to three red-shouldered hawk nests with eggs would represent 3.2% of the annual nesting activity, if the breeding pairs do not relocate and nest in another location. Placement into permanent captivity would only be done with the express authorization of the RIDEM. Placement would be with properly licensed wildlife rehabilitators, falconers, or zoos. The take of red-shouldered hawk and active red-shouldered hawk nests by WS would only occur when permitted and only at levels authorized on depredation permits issued by the USFWS and the RIDEM.

Broad-winged Hawk Biology and Population Impact Analysis

Broad-winged hawks are small to medium sized, stocky, forest-dwelling hawks of eastern deciduous forests. As the name implies, the wings are broad and pale with a dark trailing edge. The tail is medium to short in length with a thick white band in the middle and thinner ones near the base and tip. The face is dark and throat white. The chest is reddish with reddish barring along the sides. Juveniles are similar to adults, but with white streaking down the center of breast and a buff tail with thin dark bands (Goodrich et al. 1996).

The broad-winged hawk completely leaves its breeding grounds in the fall and winter. Huge numbers of migrating broad-wings can be seen at hawk watches across the East. It usually migrates in large flocks or "*kettles*" that can range from a couple of individuals to thousands (Haines et al. 2003). The nest is a large bowl of sticks that is lined with bark chips and is often decorated with green twigs. It may be placed upon the old nest of a row or squirrel.

Egg laying in broad-winged hawks occurs from late-April through early-June with peak egg laying occurring from early-May through late-May (Goodrich et al. 1996). Nestlings can be found from late-May through mid-August with the peak occurring from June through July (Goodrich et al. 1996). The number of eggs laid by red-shouldered hawks range from 1 to 5 eggs with averages of 2 to 3 eggs most common (Goodrich et al. 1996).

Requests for assistance with broad-winged hawks received by WS are usually associated with threats to human safety or human injury associated with nesting behavior, but may also involve threats to aircraft from strikes. Some requests for assistance may also involve real or perceived threats to household pets or livestock, such as poultry posed by broad-winged hawks that may involve nest aggression or predation. WS has responded to requests for assistance involving broad-winged hawk in neighboring Connecticut by providing technical assistance and by providing direct operational assistance using nest and egg removal and destruction, and lethal methods due to attacks on people, including the elderly, resulting in injury. WS has not previously received requests for assistance associated with broad-winged hawks in Rhode Island. Neither the WS program nor any non-WS entities have lethally taken broad-winged hawks or active broad-winged hawk nests with eggs in Rhode Island from 2006 through 2011 and no take of broad-winged hawks was authorized by the USFWS during this period.

Under the proposed action alternative, WS could be requested to use lethal methods to remove broad-winged hawks when non-lethal harassment methods were ineffective or were determined to be inappropriate for eliminating threats to human health and safety, damage or threats of damage using WS Decision Model. Examples could include taking one of a pair of broad-winged hawks where nest and egg destruction was previously used but did not result in the desired outcome of the hawks relocating to a safe nesting site or removal of a broad-winged hawk that posed an immediate strike threat at an airport where attempts to disperse the broad-winged hawk were ineffective. WS could also live capture dangerous or threatening broad-winged hawks or juvenile hawks and transport them to licensed raptor rehabilitators, falconers, or zoos for temporary or permanent captivity.

WS would continue to employ primarily non-lethal methods to address requests for assistance with managing damage or threats of damage associated with broad-winged hawk in the State. Based on previous requests for assistance to manage damage associated with broad-winged hawk and in anticipation of receiving an increasing number of requests for assistance, WS could lethally take up to six broad-winged hawks and remove and destroy up to three broad-winged hawk nests with eggs annually in the State to alleviate threats and damage.

From 1966 to 2011, the number of broad-winged hawk observed along routes surveyed in the Eastern BBS Region during the BBS has shown an increasing trend estimated at 0.9% (Sauer et al. 2012). During this period, the New England/Mid-Atlantic Region and Rhode Island have seen decreases estimated at -0.5% and -3.6% annually (Sauer et al. 2012). Broad-winged hawks are highly migratory and no observations of broad-winged hawks have been recorded in Rhode Island from 1966 to 2011 in areas surveyed during the CBC. Based on BBS data, Rich et al. (2004) estimated the statewide breeding population of broad-winged hawk at 900 birds. BirdLife International (2012) ranks the broad-winged hawk as a species of least concern.

Based on a statewide population estimated at 900 broad-winged hawk and if up to six broad-winged hawk were taken in any given year, WS' take would represent 0.7% of the estimated population if the population remained at least stable. A population of 900 broad-winged hawks would represent approximately 450 breeding pairs. WS' removal and destruction of up to three broad-winged hawk nests with eggs would represent 0.7% of the annual nesting activity, if the breeding pairs did not relocate and nest in another location. The take of broad-winged hawks and active broad-winged hawk nests by WS would only occur when permitted and only at levels authorized on depredation permits issued by the USFWS and the RIDEM.

Red-tailed Hawk Biology and Population Impact Analysis

The red-tailed hawk is probably the most common hawk in North America. Individuals can be observed on almost any car ride of even moderate length, anywhere in Rhode Island. Red-tailed hawks soar above

open fields, slowly turning circles on their broad, rounded wings or sit atop telephone poles, signs or trees along highways, eyes fixed on the ground to catch the movements of a vole or a rabbit (Preston and Beane 2009).

Red-tailed Hawks are large hawks with very broad, rounded wings and a short, wide tail. Large females seen from a distance may resemble an eagle. Most red-tailed hawks are rich brown above and pale below, with a streaked belly. Under the wing, there is a dark bar between shoulder and wrist. The tail is usually pale below and cinnamon-red above and red can be seen in flight. Tails in young birds are brown and banded. Dark phase birds are all usually chocolate brown with a warm red tail. Rufous phase birds are reddish brown on the chest with a dark belly (Preston and Beane 2009).

Requests for assistance with red-tailed hawks received by WS are usually associated with threats to human safety or human injury associated with nesting behavior, but may also involve threats to aircraft from strikes. Some requests for assistance may also involve real or perceived threats to household pets or livestock, such as poultry posed by red-tailed hawks that may involve nest aggression or predation.

WS has responded to requests for assistance involving red-tailed hawk previously by providing technical assistance and by providing direct operational assistance through non-lethal harassment methods. Between FY 2006 and FY 2012, the WS program in Rhode Island addressed 127 red-tailed hawks through non-lethal dispersal airports. No red-tailed hawks or active red-tailed hawk nests with eggs were lethally taken or destroyed by WS from FY 2006 through FY 2012. No red-tailed hawks or active red-tailed hawk nests with eggs were lethally taken or destroyed by non-WS entities under depredation permits from 2006 to 2011 and no take was authorized by the USFWS.

Under the proposed action alternative, WS could be requested to use lethal methods to remove red-tailed hawks when non-lethal harassment methods were ineffective or were determined to be inappropriate for eliminating threats to human health and safety, damage or threats of damage using WS Decision Model. Examples could include taking one of a pair of red-tailed hawks where nest and egg destruction was previously used but did not result in the desired outcome of the hawks relocating to a safe nesting site or removal of a red-tailed hawk that poses an immediate strike threat at an airport where attempts to disperse the red-tailed hawk were ineffective. WS could also live capture dangerous or threatening red-tailed hawks or juvenile hawks and transport them to licensed raptor rehabilitators, falconers, or zoos for temporary or permanent captivity. Based on previous requests for assistance to manage damage associated with red-tailed hawk and in anticipation of receiving an increasing number of requests for assistance, WS could lethally take up to six red-tailed hawks and three active red-tailed hawk nests annually in the State to alleviate threats and damage.

From 1966 to 2011, the number of red-tailed hawk observed along routes surveyed in the Eastern BBS Region, New England/Mid-Atlantic Region, and Rhode Island during the BBS has shown increasing trends estimated at 1.2%, 3.6%, and 5.9% annually, respectively (Sauer et al. 2012). The number of red-tailed hawks observed and the number of red-tailed hawks observed per party hour in areas surveyed during the CBC have shown significantly increasing trends in the State from 1966 to 2011 (NAS 2010). The CBC surveys with the highest numbers observed were 2010 and 2011 with 119 and 122 red-tailed hawks, respectively (NAS 2010). Based on BBS data, Rich et al. (2004) estimated the statewide population of red-tailed hawk was 100 birds. BirdLife International (2012) ranks the red-tailed hawk as a species of least concern.

Based on a statewide population estimated at 100 red-tailed hawk and if up to six red-tailed hawks were taken in any given year, WS' take would represent 6.0% of the estimated population if the population remained at least stable. A population of 100 red-tailed hawks would represent approximately 50 breeding pairs, WS' removal and destruction of up to three red-tailed hawk nests with eggs would

represent 6.0% of the annual nesting activity, if the breeding pairs do not relocate and nest in another location. The take of red-tailed hawks and active red-tailed hawk nests by WS would only occur when permitted and only at levels authorized on depredation permits issued by the USFWS and the RIDEM.

Rock Pigeon Biology and Population Impact Analysis

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

Pigeons are closely associated with humans where human structures and activities provide them with food and sites for roosting, loafing, and nesting (Williams and Corrigan 1994). Thus, pigeons are commonly found around city buildings, bridges, parks, farmyards, grain elevators, feed mills, and other manmade structures (Williams and Corrigan 1994). Additionally, although pigeons are primarily grain and seed eaters, they will readily feed on garbage, livestock manure, spilled grains, insects, and any other available bits of food (Williams and Corrigan 1994). In Rhode Island, pigeons can be found statewide throughout the year (Johnston 1992).

The number of pigeons observed along routes surveyed during the BBS in the State have shown a declining trend since 1966, which has been estimated at -0.6% annually. From 2001 through 2011, the number of pigeons observed along routes surveyed has shown a decreasing trend estimated at -0.4% annually (Sauer et al. 2012). Since 1966, the number of pigeons observed along routes surveyed during the BBS across the New England/Mid-Atlantic Coast Region has shown a declining trend estimated at -3.3% annually with a -2.7% annually decline from 2001 through 2011 (Sauer et al. 2012). Based on data from the BBS, Rich et al. (2004) estimated the statewide breeding population at 8,000 pigeons. The number of pigeons observed in areas surveyed during the CBC has shown a general declining trend in the State since 1974, which is the first year pigeons appear in CBC records for the State (NAS 2010). BirdLife International (2012) ranks the rock pigeon as a species of least concern.

Since pigeons are afforded no protection under the MBTA because the species is not native to the United States, the take of pigeons to alleviate damage or to reduce threats can occur without the need for a depredation permit from the USFWS or the RIDEM. Therefore, take by other entities in Rhode Island is unknown. In FY 2012, WS employed non-lethal harassment methods to disperse three pigeons to alleviate damage or threats of damage. WS also employed lethal methods to take 47 pigeons during FY 2012. In addition, WS destroyed three pigeon nests containing six eggs during FY 2012. WS did not receive requests for direct operational assistance associated with pigeons from FY 2006 through FY 2011.

The take of pigeons by other entities in the State to alleviate damage or threats of damage is unknown since the reporting of take to the USFWS or any other entity is not required. Since pigeons are a non-native species that often competes with native wildlife species for food and habitat, any take could be viewed as benefiting the native environment in Rhode Island.

Based on previous requests for assistance and in anticipation of additional efforts, WS could annually take up to 1,000 pigeons in the State to alleviate damage. In addition, up to 100 pigeon nests could be destroyed by WS annually, including those eggs contained within those nests. Based on a population estimated at 8,000 pigeons, take of up to 1,000 pigeons by WS would represent 12.5% of the estimated statewide population. WS' proposed activities involving pigeons would be conducted pursuant to

Executive Order 13112, which states that each Federal agency should reduce invasion of exotic species and the associated damages.

Mourning Dove Biology and Population Impact Analysis

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

According to trend data provided by Sauer et al. (2012), the number of mourning doves observed on routes surveyed has shown an increasing trend in the State estimated at 2.1% annually from 1966 through 2011. From 2001 through 2011, the number of doves observed in areas surveyed during the BBS in the State has increased annually estimated at 2.0% (Sauer et al. 2012). From 1966 through 2011, the number of doves heard and seen during the annual Mourning Dove-count Survey has increased 2.0% annually in the New England areas (Seamans et al. 2012). Based on BBS data, Rich et al. (2004) estimated the statewide breeding population at 20,000 mourning doves. BirdLife International (2012) ranks the mourning dove as a species of least concern.

The number of mourning doves observed during the CBC has shown a general stable to slightly declining trend in the State since 1966 (NAS 2010). Many states have regulated annual hunting seasons for doves each year with generous bag limits. Across the United States, the preliminary mourning dove harvest in 2011 was estimated at 16.6 million doves with 100 doves harvested in Rhode Island (Raftovich et al. 2012). Table 4.11 shows the number of doves harvested in Rhode Island during the annual hunting season from 2006 through 2011.

Table 4.11 – Number of mourning doves addressed and harvested in Rhode Island, 2006 to 2012

Year	Dispersed by WS[1]	Take under Depredation Permits				
		WS' Take[1]	Non-WS' Take Authorized	Non-WS' Take[2]	Hunter Harvest[3]	Total Reported Take
2006	0	9	600	311	500	1220
2007	61	19	350	0	2,000	519
2008	53	1	0	0	4,400	2,001
2009	158	7	700	310	50	4,717
2010	118	12	700	517	7,800	579
2011	112	2	N/A[†]	N/A	100	7,802
2012	904	31	N/A	N/A	N/A	131
TOTAL	**1,406**	**81**	**2,350**	**1,138**	**14,850**	**16,969**

[1]Data reported by federal fiscal year
[2]Data reported by calendar year
[3]Hunting season year begins in the fall of the previous year correlating with the following federal fiscal year, for example the 2005 hunting season occurred during fiscal year 2006.
[†]Data is currently unavailable

From FY 2006 through FY 2012, WS has addressed 1,487 doves to alleviate damage and threats (see Table 4.11). Of those doves addressed by WS from FY 2006 through FY 2012, 81 doves were addressed using lethal methods while 1,406 doves were addressed using non-lethal methods. Requests for assistance received by WS often arise from airports where the gregarious flocking behavior of doves can pose risks to aircraft at or near airports. Based on the number of requests to manage damage associated with doves received previously and based on the increasing need to address damage and threats associated

with doves in the State, up to 500 mourning doves could be lethally taken by WS annually in the State to address damage or threats.

An annual take by WS of up to 500 mourning doves would represent 2.5% of the estimated statewide breeding population of 20,000 doves based on a stable population trend. The USFWS has authorized other entities to remove up to 700 doves annually, which represents the highest annual removal permitted by the USFWS from 2006 through 2012. If 700 doves were removed under permits issued by the USFWS and WS lethally removed 500 doves, the cumulative take to alleviate damage would represent 6.0% of the estimated breeding population in the State, if take only occurred during the breeding season. Doves are primarily targeted to alleviate strike risks at airports where the flocking behavior of doves during migration periods can increase aircraft strike risks at airports. Therefore, take would likely represent a much smaller portion of the breeding the population.

Local populations of mourning doves in the State are likely augmented by migrating birds during the migration periods and during the winter months. Like other native bird species, the take of mourning doves by WS to alleviate damage would only occur when permitted by the USFWS pursuant to the MBTA through the issuance of depredation permits and when authorized by the RIDEM. Therefore, the take of mourning doves by WS would only occur and only at levels authorized by the USFWS and the RIDEM, which ensures WS' take and take by all entities, including hunter harvest, would be considered to achieve the desired population management levels of doves in Rhode Island.

Monk Parakeet Biology and Population Impact Analysis

The monk parakeet is a native of South America, occurring from Bolivia to southern Brazil to central Argentina. The species has been introduced and become established as a breeding species in the United States and Europe (Spreyer and Bucher 1998). Parakeets are popular as pets in the United States and localized free-ranging populations have become established from purposeful and accidental releases (Spreyer and Bucher 1998). Whether from purposeful or accidental releases by pet owners or pet shops, the first localized populations of monk parakeets in United States became established during the 1960s (Spreyer and Bucher 1998). Florida, Illinois, New York, Rhode Island, and Texas have some of the largest free-ranging populations of monk parakeets in the United States (Spreyer and Bucher 1998, Avery et al. 2002*b*).

Monk parakeets average 29 cm (11.4 inches) long with a wingspan of 48 cm (18.9 inches) and weighs 100 g (3.5 oz.). The species is sexually dimorphic and females tend to be 10 to 20% smaller; however, they can only be reliably sexed by DNA or feather testing. Monk parakeets have bright green upper parts; the breast and forehead are pale gray with darker scalloping and the rest of the underparts are very light green to yellow in color. The wing feathers are dark blue and the tail is long and tapers. The bill is orange (Collar 1997).

The monk parakeet is the only parrot that builds a stick nest, in a tree or on a man-made structure, rather than using a hole in a tree. In addition to nest building, the species is gregarious and normally nests colonially, building a single large nest with separate entrances for each pair. The colonies can become quite large and in exceptional cases, these stick nests may have more than 200 chambers, but most have only 1 to 20 (Spreyer and Bucher 1998). Although the size of nests varies, nests with one chamber normally have a diameter of <0.8 meters while nests consisting of four to 15 chambers have a diameter of >1.5 meters (Spreyer and Bucher 1998). In exceptional cases, compound nests weighing 1,200 kg (2,646 lbs) have been reported (Spreyer and Bucher 1998). Nest maintenance is a year-round activity and all members of the colony, including sexually immature birds will add sticks to the nest (Bull 1973, Spreyer and Bucher 1998).

Nest serve as both a permanent roosting site and nesting site. Parakeets quickly rebuild destroyed nests, even during the non-breeding season (Spreyer and Bucher 1998, Avery et al. 2002*b*). A pair of parakeets can build a nest in less than two weeks. Nests often begin as single nests but often expand each year as the original pair builds onto the nest and other pairs build nests on top of or surrounding the nest (Spreyer and Bucher 1998, Avery et al. 2002*b*). Monk parakeets often build nests on utility poles and other utility structures (Spreyer and Bucher 1998, Avery et al. 2002*b*, Avery et al. 2006*a*). Parakeet nests can be a threat to the safe operation of electrical transmission structures due to the risk of outages caused when parakeets carrying sticks or sticks from the nest short-circuit transmission equipment. The nests can present a risk of power outages and fire that could result in the loss of power to thousands of customers (Avery et al 2002, Avery et al. 2006*a*, Pruett-Jones et al. 2007).

Since parakeets will quickly rebuild destroyed nests at the same location, the most effective approach to resolving the threat of damage associated with the nest is to remove the parakeets with the nest (Avery et al. 2002*b*, Tillman et al. 2004).

Monk parakeets are relatively common in eastern Kent County, Rhode Island in urban and suburban areas where they nest in trees. Although breeding populations are known to occur in Rhode Island, no data from the BBS is available for parakeets (Sauer et al. 2012), likely due to their use of suburban areas for nesting and their isolated breeding populations. Monk parakeets have also not been observed during the CBC conducted annually in the State (NAS 2010).

Van Bael and Pruett-Jones (1996) found the population size and geographical range of parakeets was experiencing an exponential growth trend in the United States. In the absence of a control program, Van Bael and Pruett-Jones (1996) estimated the population would continue to increase and expand in the United States. Parakeets are not generally considered migratory in the United States. The statewide population in Rhode Island is currently unknown. Monk parakeets are considered highly gregarious with colonies of several hundred parakeets often observed, which may be present in the same areas for many years. Monk parakeets can compete with native wildlife species for food and natural nesting locations. In addition, large flocks of parakeets cause agricultural damage in areas where the species is native (Spreyer and Bucher 1998). In the United States, parakeets are responsible for causing damage to electrical transmission equipment from their nest building behavior (Avery et al. 2002*b*, Avery et al. 2006*a*). Most requests for assistance received by WS would be associated with nests on utility structures or other structures.

WS has not previously been requested to provide direct operational assistance associated with monk parakeets in the State. Since monk parakeets are colonial nesters and often build nests on man-made structures (*e.g.*, utility poles) (Avery et al. 2002*b*), WS could address up to 100 parakeets per year in the State to address requests for assistance and destroy up to 20 nests annually. Monk parakeets are not protected from take under the MBTA and take can occur without the need for a depredation permit. The number of monk parakeets lethally removed by other entities within the State to alleviate damage is unknown.

Although actual population estimates are not available for monk parakeets, WS would conduct removal activities pursuant to Executive Order 13112, which states that each Federal agency whose actions may affect the status of invasive species shall reduce invasions of exotic species and the associated damages.

American Crow Biology and Population Impact Analysis

American crows have a wide range and are extremely abundant, being found across the United States (Verbeek and Caffrey 2002). Crows are found in both urban and rural environments and in Rhode Island sometimes forming large communal roosts in cities. In the United States, some crow roosts may reach a

half-million birds (Verbeek and Caffrey 2002). American crows can be found throughout the State and they can be found throughout the year (Robbins and Blom 1996).

Historically, crow populations have likely benefited from agricultural development because of grains available as a food supply. Crows typically roost in trees with the combination of food and tree availability being favored. In some areas where abundant food and roosting sites are available, large flocks of crows tend to concentrate. In the fall and winter, crows often form large roosting flocks in urban areas. Those large flocks disperse to different feeding areas during the day. Crows can fly from six to 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.

American crows have a wide range and are extremely abundant, being widely distributed over much of North America, including most of the United States (Johnson 1994). American crow populations increased drastically after protection under the MBTA. Populations tend to be densest and increasing most rapidly in urban areas of North America (Marzluff et al. 2001). In the United States, some crow roosts may reach a half-million birds or greater in size (Johnson 1994). From 1966 through 2011, the number of American crows observed in areas surveyed in the State during the BBS has increased 0.1% annually (Sauer et al. 2012). From 2001 through 2011, the number of crows observed in the State has increased 0.3% annually (Sauer et al. 2012). In the New England/Mid-Atlantic Coast Region, the number of crows observed during the BBS has increased 0.9% annually from 1966 through 2011 and declined -0.3% annually from 2001 through 2011 (Sauer et al. 2012). Rich et al. (2004) estimated the breeding American crow population in Rhode Island to be 7,000 individuals. The number of crows observed during winter surveys has shown a general increasing trend in the State (NAS 2010). BirdLife International (2012) ranks the American crow as a species of least concern.

From FY 2006 through FY 2012, WS employed lethal methods to take 57 American Crows in Rhode Island and employed non-lethal methods to disperse 1,998 American Crows (see Table 4.12). The highest level of take by WS occurred in FY 2012 when 46 crows were lethally removed. Based on the requests for assistance received previously and the relative abundance of crows in the State, WS anticipates that up to 500 American crows could be lethally removed annually to alleviate requests for assistance.

Table 4.12 – Number of American crows addressed by WS in Rhode Island by WS, FY 2006 - FY 2012

Year	Dispersed by WS	WS' Take
2006	11	0
2007	4	2
2008	2	0
2009	73	8
2010	34	0
2011	78	1
2012	1,796	46
TOTAL	**1,998**	**57**

With a statewide population estimated at 7,000 American crows, an annual take by WS of 500 crows would represent 7.1% of the estimated population if the population remains stable. The take of crows by other entities either to alleviate damage or threats of damage or during the annual hunting seasons is unknown. Given the relative abundance of American crows in the State and the long-term stable to increasing population trends observed for the species, the take of crows by other entities to alleviate

damage or threats of damage and the take of crows during the annual hunting season is likely of low magnitude.

The use of population trends as an index of magnitude is based on the assumption that annual harvests do not exceed allowable harvest levels. State wildlife management agencies act to avoid over-harvests by restricting take (either through hunting season regulation and/or permitted take) to ensure that annual harvests are within allowable harvest levels. If crow populations remain stable in the State, WS' annual take of up to 500 American crows would represent 7.1% of the estimated statewide crow population. The take of crows under the depredation order by other entities is likely to be a small contributor to the cumulative take of crows annually. Although some take is likely to occur, take is not expected to reach a high magnitude. Similarly, the take of crows during the annual hunting season is likely of low magnitude when compared to the statewide population. The number of American crows, observed during long-term statewide surveys, is showing increasing trends (NAS 2010, Sauer et al. 2012). The population of crows has likely remained at least stable despite the take of crows by WS and other entities under the depredation order and during the annual hunting season.

Fish Crow Biology and Population Impact Analysis

The fish crow can be found from Maine to south Florida and west to south Texas where they commonly occur along tidal marshes, beaches, inland lakes, and river systems (McGowan 2001). 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 lakeshores, pinewoods, and occasionally in towns, residential, or other urban areas. Difficulty in identifying this species probably has led to an underestimate of its range, both current and historic. Although the fish crow is slimmer and has a narrower beak and smaller legs, it is difficult to distinguish from the American crow (Fussell 1994, McGowan 2001).

Fish crows are often confused with American crows with the only reliable distinction between the two species being vocal (McGowan 2001). The best way to identify fish crows is by their short nasal calls. However, juvenile American crows do have a similar sounding call in late spring and summer (RIDEM 2012*b*). Crows often form mixed species roosts that can contain both American crows and fish crows. 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. Nesting behavior of fish crows is also similar to American crows; however, they do nest higher at approximately 20 to 80 feet above the ground and build slightly smaller nests (Connecticut Department of Energy and Environmental Protection 2012).

Fish crows are present in the State throughout the year (McGowan 2001), with the number of crows present in the State increasing during the late fall and winter as crows begin arriving in the State from further north. Although fish crows and American crows can form mixed species flocks, most flocks of crows or crow roosts encountered in the State consists primarily of American Crows. Based on previous requests for assistance with American crows and in anticipation of requests to disperse urban crow roosts or address roosts near airports, up to 100 fish crows could be taken by WS annually under the proposed action. Although not as widely distributed in the State, fish crows could be present in flocks of crows addressed by WS. The number of fish crows observed during the BBS has shown an increasing trend in the New England/Mid-Atlantic Coast region since 1966 estimated at 2.9% annually, with a 3.3% annual increase occurring from 2001 through 2011 (Sauer et al. 2012). No trend data from the BBS is currently available for Rhode Island (Sauer et al. 2012). The number of fish crows observed during the CBC has also shown a general increasing trend since 1966 (NAS 2010). BirdLife International (2012) ranks the fish crow as a species of least concern.

WS has not previously received requests for assistance associated with fish crows specifically and fish crows were not known to be present during previous dispersal activities targeting American crows. 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 in the State during a regulated season that allows an unlimited number of crows to be harvested. Since the take of crows can occur without a permit from the USFWS under the blackbird depredation order, there were no reporting requirements for the take of crows to reduce damage or reduce threats until recently. Therefore, the number of fish crows taken in the State under the depredation order to alleviate damage or reduce threats is unknown. Similarly, hunters harvesting crows during the regulated hunting season are not required to report their take to the USFWS or the RIDEM.

Fish crows are not as abundant as American crows and are not as widely distributed across the State. American crows can be found throughout the State while fish crows are most commonly found along the coast of Rhode Island and along rivers. Although not as abundant in the State, fish crows could be present in flocks of crows addressed by WS.

Given increasing population trends in the New England/Mid-Atlantic Coast Region during the BBS and in Rhode Island during CBC surveys, take of up to 100 fish crows annually by WS would not adversely affect the statewide population of fish crows. Similar to American crows, the number of fish crows taken annually to alleviate damage or taken during the annual hunting season in the State is unknown. However, given the relative abundance of fish crows when compared to the abundance of American crows and given the more specific habitat preferences of fish crows, the number of fish crows taken or harvested annually is likely to represent a small portion of the total take of crows in the State.

WS anticipates that the take of fish crows would be limited and would most likely occur in conjunction with requests for assistance to manage damage associated with urban crow roosts where American crows and fish crows occur in mixed species flocks. Trend data from the BBS indicate the number of fish crows observed along routes surveyed in the New England/Mid-Atlantic Coast Region have increased from 1966 to 2011. Data from the CBC also indicates the number of fish crows observed overwintering in the State have shown a general increasing trend. Therefore, the magnitude of the proposed take by WS would likely be low.

Horned Lark Biology and Population Impact Analysis

Easily identified by its black tufted head feathers or '*horns*', horned larks can be found across most of the United States, in suitable habitat (Beason 1995). Horned larks are a widespread occupant of open habitats that prefer areas with sparse vegetation and exposed soil. Preferred habitat consists of open country, including short grass prairie, deserts and alpine habitat or other areas with low vegetation (Beason 1995), making airports attractive habitat. Horned larks nest and feed on the ground (Beason 1995). Diet consists of seeds, insects, and sprouting crops (*e.g.*, lettuce, wheat, oats) (Beason 1995). A social species, horned larks form flocks during the non-breeding season of up to several hundred birds, which may join with other flocks of similar sized birds that utilize similar habitats (Beason 1995). In eastern North America, most breeding pairs occupy tilled fields, the grassy fields bordering airports, and similar habitats and they are occasionally found in vacant lots within cities (Peterson 1980).

Due to winter flocking behavior and preference for open habitats, larks can pose aircraft strike risks at airports. The horned lark was the most common bird, identified to species, struck by aircraft of the United States Air Force from 1995 to 2011, which resulted in almost $2 million in damages (United States Air Force 2012).

In the New England/Mid-Atlantic Coast Region, the number of horned larks observed along routes surveyed during the BBS have remained stable since 1966, but have shown a declining trend from 2001 to 2011 estimated at -1.3% annually (Sauer et al. 2012). The number of horned larks observed in the Eastern BBS region has declined at an estimated -2.7% annually since 1966 and -1.4% annually from 2001 to 2011 (Sauer et al. 2012). No trending data is currently available in Rhode Island from the BBS (Sauer et al. 2012). Rich et al. (2004) estimated the breeding population of horned larks at 400 larks. The number of horned larks observed in areas surveyed during the CBC has shown a declining trend since 1966 (NAS 2010). BirdLife International (2012) ranks the horned lark as a species of least concern.

The number of horned larks lethally removed or dispersed by WS and the total number of horned larks lethally removed by all entitles from 2006 to 2012 to alleviate damage are shown in Table 4.13. From FY 2006 through FY 2011, WS lethally removed two larks and used non-lethal methods to disperse 1,553 horned larks in the State. In addition to the take by WS, the USFWS issued depredation permits to other entities for the take of horned larks during this period. From 2006 to 2010, the USFWS authorized other entities to remove up to 300 larks total, with the highest authorized annual take being 100 larks.

Table 4.13– Number of horned larks addressed in Rhode Island, 2006 to 2012

Year	Dispersed by WS[1]	Take under Depredation Permits			
		WS' Take[1]	Non-WS' Take Authorized	Non-WS' Take[2]	Total Take by All Entities[2]
2006	0	0	100	49	49
2007	50	0	0	0	0
2008	157	1	0	0	1
2009	185	0	100	16	16
2010	175	0	100	2	2
2011	351	1	N/A[†]	N/A	1
2012	635	0	N/A	N/A	0
TOTAL	**1,553**	**2**	**300**	**67**	**69**

[1]Data reported by federal fiscal year
[2]Data reported by calendar year
[†]Data is currently unavailable

To address anticipated requests for assistance to manage damage associated with horned larks, up to 50 horned larks could be lethally removed annually by WS to alleviate damage and threats. Horned larks are listed as a species of concern by the RIDEM; however, birds are listed based on the status of their breeding population in Rhode Island. WS anticipates no more than 10 horned larks would be taken during the nesting season, from March to June, annually. If 10 horned larks were lethally removed during the breeding season, the removal would represent 2.5% of the estimated breeding population in Rhode Island.

The number of horned larks present in Rhode Island at any given time likely fluctuates throughout the year. Breeding horned larks do not generally present a major hazard to aviation safety because breeding birds do not exhibit the extensive flocking behavior that occurs during the migration periods. As stated previously, the number of horned larks present in the State during the migration periods at any given time is unknown but likely fluctuates throughout the period. The horned lark breeding population in the Atlantic Northern Forest Region (BCR 14) and the New England/Mid-Atlantic Coast Region (BCR 30) has been estimated at 12,000 and 43,000 larks, respectively (Rich et al. 2004). The lethal removal of up to 50 larks would represent 0.1% of the breeding populations in BCR 14 and BCR 30. When included with the highest authorized annual take permitted by the USFWS of 100 larks, the cumulative take of larks would represent 0.3% of the estimated breeding population in BCR 14 and BCR 30.

The take of horned larks can only occur when permitted by the USFWS and the RIDEM through the issuance of depredation permits. Therefore, all take, including take by WS, would be authorized by the USFWS and the RIDEM and occurs at their discretion. The take of horned larks would only occur at levels authorized by the USFWS and the RIDEM, which ensures cumulative take would be considered as part of population management objectives for larks. Take of up to 50 horned lark nests to alleviate damage or threats of damage would not be expected to adversely affect the population of horned larks.

Purple Martin Biology and Population Impact Analysis

The purple martin is the largest of the North American swallows and is a popular tenant of backyard birdhouses. In fact, in eastern North America, the martin has nested almost exclusively in nest boxes for more than 100 years. It has a large head, thick chest, and broad pointed wings. Male purple martins are glossy bluish-black above and below. Females are bluish black on the back; chest is dingy gray brown, belly paler dirty gray, with a collar around the back of the neck. Juveniles are similar to females, but drabber and less bluish on the back. Underparts are dirty white, wing and tail feathers are brown. First winter birds of both sexes resemble the adult female. Yearling males have a whiter belly and dark blue feathers scattered across the chest (Tarof and Brown 2013).

From 1966 to 2011, the number of purple martins observed on BBS routes has decreased in the Eastern BBS Region and increased in the New England/Mid-Atlantic Region at annual rates estimated at -0.5% and 1.0%, respectively (Sauer et al. 2012). No BBS survey data is available for purple martins in Rhode Island. Rhode Island CBC data from 1966 to 2011 shows no observations of purple martins during surveys throughout the State (NAS 2010). The Partners in Flight Landbird database estimated the population of purple martins in Rhode Island at 500 birds and the population in BCR 30, which includes all of Rhode Island, at 150,000 birds (Rich et al. 2004). BirdLife International (2012) ranks the purple martins as a species of least concern.

WS has not lethally taken or non-lethally dispersed any purple martins in Rhode Island from FY 2006 to FY 2012. No non-WS take has been authorized by the USFWS and none has occurred during this period. To address anticipated requests for assistance to manage damage associated with purple martins in the future, up to 50 purple martins could be lethally taken annually by WS to alleviate damage and threats. Take of 50 purple martins would represent 10.0% of the estimated population in Rhode Island and 0.03% of the estimated population of BCR 30, which includes all of Rhode Island. The increased level of take analyzed when compared to the take occurring by WS from FY 2006 through FY 2012 would be in anticipation of requests to address threats of aircraft strikes at airports.

The number of purple martins present in Rhode Island at any given time likely fluctuates throughout the year. Although a decreasing trend has been observed for purple martins in the Eastern BBS Region and an increasing population trend in the New England/Mid-Atlantic Region, the limited take proposed by WS when compared to the estimated breeding population in Rhode Island and compared to the breeding population in BCR 30 could be considered low. The permitting of the take by the USFWS and the RIDEM would ensure the cumulative take of purple martins in New England and the Mid-Atlantic, including the take proposed by WS in Rhode Island under this assessment, would not reach a magnitude where undesired adverse effects occur. The take of purple martins by WS would occur within allowed levels of take permitted by the USFWS and the RIDEM.

Tree Swallow Biology and Population Impact Analysis

Tree swallows are small slender songbirds. They are white underneath and shiny blue-green on top. They have a small bill, long wings, and a short, shallowly notched tail. Young females are brown on the

back with faint greenish sheen and some iridescent greenish blue feathers and white underparts, sometimes with a faint brown band across breast. Immature tree swallows are sooty gray on back, without trace of blue, dull white underparts and a dirty brown band across chest (Winkler et al. 2011).

From 1966 to 2011, the number of tree swallows observed in the Eastern BBS Region, New England/Mid-Atlantic Region, and Rhode Island are showing declining trends estimated at -1.5%, -0.2%, and -3.0% annually, respectively (Sauer et al. 2012). The Partners in Flight Landbird database estimated the population of tree swallows in Rhode Island to be 1,500 birds (Rich et al. 2004). BirdLife International (2012) ranks the tree swallows as a species of least concern.

Rhode Island CBC data from 1966 to 2011 shows decreasing trends for both the number and number per party hour of wintering tree swallows observed during surveys throughout the State (NAS 2010). It should be noted that tree swallows were only observed in Rhode Island during 22 of the 45 years of CBC surveys from 1966 to 2011. In addition, this decline could be influenced by a number of unusually high counts from 1971 to 1973 where as many as 63 individual tree swallows were observed during surveys. CBC surveys over the 11-year period of 2001 to 2011 indicate an increasing trend in the number and number per party hour of wintering tree swallows in the State. This increasing trend is even evident with surveys going back to 1974.

To alleviate threats to aviation safety, WS has lethally taken 203 tree swallows in Rhode Island, averaging 29 per year, from FY 2006 through FY 2012 (see Table 4.14). WS has also employed non-lethal methods to disperse 14,645 tree swallows in Rhode Island from FY 2006 to FY 2012. There has been no non-WS' take of swallows from 2006 to 2010. The highest level of take by WS occurred in 2012 when 73 swallows were lethally taken in the State pursuant to depredation permits issued by the USFWS.

Table 4.14 – Number of tree swallows addressed by WS in Rhode Island, 2006 - 2012

Year	Dispersed by WS[1]	Take under Depredation Permits			
		WS' Take[1]	Non-WS' Take Authorized	Non-WS' Take[2]	Total Take by All Entities[2]
2006	0	3	3	0	3
2007	0	0	3	0	0
2008	1	0	3	0	0
2009	1,010	45	100	0	45
2010	10,709	60	100	0	60
2011	1,250	22	N/A[†]	N/A	22
2012	1,675	73	N/A	N/A	73
TOTAL	**14,645**	**203**	**209**	**0**	**203**

[1]Data reported by federal fiscal year
[2]Data reported by calendar year
[†]Data is currently unavailable

To address requests for assistance to manage damage associated with tree swallows in the future, up to 200 tree swallows could be lethally taken annually by WS to alleviate damage and threats. The increased level of take analyzed when compared to the take occurring by WS from FY 2006 through FY 2012 is in anticipation of requests to address threats of aircraft strikes at airports. Take of up to 200 tree swallows would represent 13.3% of the estimated population of 1,500 birds.

The number of tree swallows present in Rhode Island at any given time likely fluctuates throughout the year. All lethal take of tree swallows from FY 2006 to FY 2012 occurred in August or September during the migration period. The permitting of the take by the USFWS and the RIDEM would ensure the cumulative take of tree swallows in New England and the Mid-Atlantic, including the take proposed by

WS in Rhode Island, would not reach a magnitude where undesired adverse effects occur. The take of swallows by WS would occur within allowed levels of take permitted by the USFWS and the RIDEM.

Northern Rough-winged Swallow Biology and Population Impact Analysis

The Northern rough-winged swallow is a small, long-winged stocky songbird with a small bill, long pointed wings, and a uniformly dull brown head and upper parts. The throat is pale brown. Juveniles are similar to adults, but with cinnamon wash on throat and indistinct cinnamon edges on brown the feathers of upper parts, most noticeably on wings. The Northern rough-winged swallow is fairly common across the United States in summer. The species derives its name from the outer wing feathers, which have small hooks or points on their leading edges (De Jong 1996).

From 1966 to 2011, the number of Northern rough-winged swallows observed on BBS routes has increased in the Eastern BBS Region and New England/Mid-Atlantic Region at annual rates estimated at 0.4% and 0.2%, respectively (Sauer et al. 2012). No BBS survey data is available for Northern rough-winged swallows in Rhode Island. Rhode Island CBC data from 1966 to 2011 shows no observations of Northern rough-winged swallows during surveys throughout the State (NAS 2010). The Partners in Flight Landbird database estimated the population of Northern rough-winged swallows in Rhode Island at 400 birds and the population in BCR 30, which includes all of Rhode Island at 23,000 birds (Rich et al. 2004). BirdLife International (2012) ranks the Northern rough-winged swallows as a species of least concern.

WS has not lethally taken or non-lethally dispersed any Northern rough-winged swallows in Rhode Island from FY 2006 to FY 2012. No non-WS take has been authorized by the USFWS nor occurred during this period. However, WS anticipates that up to 50 Northern rough-winged swallows could be lethally taken annually by WS to alleviate damage and threats. Take of 50 Northern rough-winged swallows would represent 12.5% of the estimated population Rhode Island and 0.2% of the estimated population in BCR 30, which includes all of Rhode Island. The increased level of take analyzed when compared to the take occurring by WS from FY 2006 through FY 2012 is in anticipation of requests to address threats of aircraft strikes at airports.

The number of Northern rough-winged swallows present in Rhode Island at any given time likely fluctuates throughout the year. Although BBS survey data indicate an increasing population trend observed for Northern rough-winged swallows in the Eastern BBS Region and the New England/Mid-Atlantic Coast Region, the limited take proposed by WS when compared to the estimated breeding population in Rhode Island and BCR 30 could be considered low. The permitting of the take by the USFWS and the RIDEM would ensure the cumulative take of Northern rough-winged swallows would not reach a magnitude where undesired adverse effects occur. The take of Northern rough-winged swallows by WS would occur within allowed levels of take permitted by the USFWS and the RIDEM.

Bank Swallow Biology and Population Impact Analysis

Bank swallows are small slender songbirds, white underneath and brown on top. They have a dark band across the chest, which extends down the middle of the chest. The bill is small and the wings are long. Immature bank swallows are similar to adults but have a pale edging on the back feathers. 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).

From 1966 to 2011, the number of bank swallows observed on BBS routes has decreased in the Eastern BBS Region and New England/Mid-Atlantic Coast Region at annual rates estimated at -7.4% and -2.5%, respectively (Sauer et al. 2012). No BBS survey data is available for bank swallows in Rhode Island.

Rhode Island CBC data from 1966 to 2011 shows no observations of bank swallows during surveys throughout the State (NAS 2010). The statewide population of bank swallows is unknown. However, the population of bank swallows in BCR 30 was estimated at 20,000 birds (Rich et al. 2004). BirdLife International (2012) ranks the bank swallows as a species of least concern.

WS has not lethally taken or non-lethally dispersed any bank swallows in Rhode Island from FY 2006 to FY 2012. No non-WS take has been authorized by the USFWS nor 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. Take of 100 bank swallows would represent 0.5% of the estimated population in BCR 30. The increased level of take analyzed when compared to the take occurring by WS from FY 2006 through FY 2012 is in anticipation of requests to address threats of aircraft strikes at airports and to reduce 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.

The number of bank swallows present in Rhode Island at any given time likely fluctuates throughout the year. Although BBS data indicate a decreasing population trend observed for bank swallows in the Eastern BBS Region and the New England/Mid-Atlantic Coast Region, the limited take proposed by WS when compared to the estimated breeding population in BCR 30 could be considered low. The permitting of the take by the USFWS and the RIDEM would ensure the cumulative take of bank swallows would not reach a magnitude where undesired adverse effects occur. The take of bank swallows by WS would occur within allowed levels of take permitted by the USFWS and the RIDEM.

Barn Swallow Biology and Population Impact Analysis

The sparrow-sized barn swallow is steely cobalt blue above on back, wings and tail, and is rufous to tawny below. A blue crown and face contrast with the cinnamon-colored forehead and throat. White spots under the tail can be difficult to see except in flight. Males are more boldly colored than females. When perched, the barn swallow appears cone shaped, with a slightly flattened head, no visible neck, and broad shoulders that taper to long and pointed wings. The tail extends well beyond the wingtips and the long outer feathers give the tail a deep fork (Brown and Brown 1999).

The tail is long and deeply forked, streaming out behind this agile flyer and sets it apart from all other North American swallows. Barn swallows often cruise low, flying just a few inches above the ground or water, darting gracefully over fields, barnyards, and open water in search of flying insect prey. As the name implies, they build their cup-shaped mud nests almost exclusively on human-made structures (Brown and Brown 1999).

From 1966 to 2011, the number of barn swallows observed on BBS routes has decreased in the Eastern BBS Region, New England/Mid-Atlantic Coast Region, and Rhode Island at annual rates estimated at -1.7%, -1.1%, and -3.7%, respectively (Sauer et al. 2012). Rhode Island CBC data from 1966 to 2011 shows no observations of barn swallows during surveys throughout the State (NAS 2010). The Partners in Flight Landbird database estimated the population of barn swallows in Rhode Island to be 4,000 birds (Rich et al. 2004). BirdLife International (2012) ranks the barn swallows as a species of least concern.

To alleviate threats to aviation safety, WS has lethally removed five barn swallows in Rhode Island, averaging 0.7 per year, from FY 2006 through FY 2012. WS has also employed non-lethal methods to disperse 676 barn swallows in Rhode Island from FY 2006 to FY 2012. As shown in Table 4.15, there has been 48 barn swallows lethally taken by non-WS' entities from 2006 to 2010. The highest level of non-WS take occurred in 2010 when 31 swallows were lethally taken in the State pursuant to depredation

permits issued by the USFWS. Non-WS take has averaged at least eight swallows annually from 2006 to 2010.
To address requests for assistance to manage damage associated with barn swallows in the future, up to 200 barn swallows could be lethally taken annually by WS to alleviate damage and threats representing 5.0% of the estimated statewide population of 4,000 barn swallows. The increased level of take analyzed when compared to the take occurring by WS from FY 2006 through FY 2012 is in anticipation of requests to address threats of aircraft strikes at airports and to reduce damage to property and agricultural resources, caused by nesting in man-made structures.

If the average annual take of eight barn swallows by other entities were reflective of take that would occur in the future, the combined WS' take and take by other entities would total 208 barn swallows, or 5.2% of the estimated population annually. When included with the highest barn swallows take that occurred by all entities of 31 barn swallows in 2010, take of up to 200 barn swallows by WS annually would total 231 barn swallows lethally taken in the State, representing 5.8% of the estimated population.

Table 4.15– Number of barn swallows addressed in Rhode Island, 2006 - 2012

Year	Dispersed by WS[1]	Take under Depredation Permits			
		WS' Take[1]	Non-WS' Take Authorized	Non-WS' Take[2]	Total Take by All Entities[2]
2006	0	0	50	16	16
2007	90	0	25	0	0
2008	0	0	25	0	0
2009	203	2	125	1	3
2010	39	0	125	31	31
2011	210	1	N/A†	N/A†	1
2012	134	2	N/A	N/A	2
TOTAL	**676**	**5**	**681**	**48**	**53**

[1]Data reported by federal fiscal year
[2]Data reported by calendar year
†Data is currently unavailable

The number of barn swallows present in Rhode Island at any given time likely fluctuates throughout the year. Although BBS survey data indicate a decreasing population trend observed for barn swallows in Rhode Island, the limited take proposed by WS when compared to the estimated breeding population could be considered low. The permitting of the take by the USFWS and the RIDEM would ensure the cumulative take of barn swallows would not reach a magnitude where undesired adverse effects occur. The take of barn swallows by WS would occur within allowed levels of take permitted by the USFWS and the RIDEM.

Snow Bunting Biology and Population Impact Analysis

Appropriately named, the snow bunting is a bird that nests in the high Arctic and snowy winter fields. Even on a warm day, the mostly white plumage of a bunting flock evokes the image of a snowstorm. Non-breeding or basic male plumage exhibits a white head, breast, belly, flanks, and rump and brown tipped forehead, crown, nape, and face feathers. Feathers on the back and parts of the wings are black with white or rufous tips. A faint brick red band runs across top of the chest and the bill is yellowish orange with black tip. Female basic plumage is similar. The bill is yellowish orange without the black tip.

WS has lethally taken one and non-lethally dispersed 808 snow buntings in Rhode Island from FY 2006 to FY 2012 (see Table 4.16). There were no snow buntings taken by non-WS' entities from 2006 to

2010. To address anticipated requests for assistance to manage damage associated with snow buntings in the future, up to 50 snow buntings could be lethally taken annually by WS to alleviate damage and threats. The increased level of take analyzed when compared to the take occurring by WS from FY 2006 through FY 2012 is in anticipation of requests to address threats of aircraft strikes at airports.

Snow buntings do not breed in the continental United States. Rhode Island CBC data from 1966 to 2011 shows the number of snow buntings observed during surveys has declined throughout the State (NAS 2010). BirdLife International (2012) ranks the snow bunting as a species of least concern.

Table 4.16– Number of snow buntings addressed by WS in Rhode Island, 2006 - 2012

Year	Dispersed by WS[1]	Take under Depredation Permits			
		WS' Take[1]	Non-WS' Take Authorized	Non-WS' Take[2]	Total Take by All Entities[2]
2006	0	0	50	0	0
2007	0	0	50	0	0
2008	100	0	25	0	0
2009	40	0	25	0	0
2010	38	0	30	1	1
2011	500	1	N/A†	N/A†	1
2012	130	0	N/A†	N/A†	0
TOTAL	**808**	**1**	**180**	**1**	**2**

[1]Data reported by federal fiscal year
[2]Data reported by calendar year
†Data is currently unavailable

There are no population estimates available for snow buntings in Rhode Island. The number of snow buntings present in Rhode Island at any given time likely fluctuates from the fall migration, winter, and spring migration. Snow buntings are not present during the breeding season. The limited take proposed by WS could be considered low. The permitting of the take by the USFWS and the RIDEM would ensure the cumulative take of snow buntings would not reach a magnitude where undesired adverse effects occur. The take of snow buntings by WS would occur within allowed levels of take permitted by the USFWS and the RIDEM.

House Sparrow Biology and Population Impact Analysis

House sparrows were introduced to North America from England in 1850. From that introduction, sparrows have spread throughout the continent (Fitzwater 1994). House sparrows are found in nearly every habitat except dense forest, alpine, and desert environments. They prefer human-altered habitats, and are abundant on farms and in cities and suburbs (Robbins 1973). House sparrows are not considered migratory in North America and are considered year-round residents wherever they occur, including those sparrows found in Rhode Island (Lowther and Cink 2006). Nesting locations often occur in areas of human activities and are considered "*...fairly gregarious at all times of year*" with nesting occurring in small colonies or in a clumped distribution (Lowther and Cink 2006). Large flocks of sparrows can also be found in the winter as birds forage and roost together.

According to BBS trend data provided by Sauer et al. (2012), the number of house sparrows observed along routes surveyed across the United States have shown a downward trend estimated at -3.7% annually between 1966 and 2011. In Rhode Island, the number of house sparrows observed in areas surveyed during the BBS has also shown a downward trend between 1966 and 2011 estimated at -1.1% annually (Sauer et al. 2012). Rich et al. (2004) estimated the breeding population of house sparrows in the State to be 18,000 birds. Since 1966, the number of house sparrows observed in areas surveyed during the CBC

annually has shown an overall declining trend (NAS 2010). BirdLife International (2012) ranks the house sparrow as a species of least concern.

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

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

Between FY 2006 and FY 2012, WS has employed non-lethal methods to disperse 346 sparrows and lethal methods to remove 37 house sparrows in the State to alleviate damage or threats of damage. In addition, 19 inactive nests were removed and destroyed. Since house sparrows are afforded no protection from take under the MBTA, no depredation permits are issued for the take of house sparrows and there are no requirements to report take of sparrows. Therefore, the number of sparrows lethally removed by other entities in the State is unknown. Based on the gregarious behavior of sparrows and in anticipation of additional efforts, WS could take up to 1,000 house sparrows in the State annually to alleviate damage or threats of damage. In addition, up to 500 active house sparrow nests could be destroyed annually by WS.

If up to 1,000 sparrows were lethally removed by WS annually in the State, the take would represent 5.6% of the statewide breeding population if the population were at least stable. As stated previously, the annual take of house sparrows by other entities is currently not known. Since house sparrows are a non-native species that often competes with native wildlife species for food and habitat, any take could be viewed as providing some benefit to the native environment in Rhode Island. WS' take of house sparrows to reduce damage and threats would comply with Executive Order 13112.

Red-winged Blackbird Biology and Population Impact Analysis

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

In Rhode Island, red-winged blackbirds are present during the breeding season and migration periods, with some blackbirds present during the winter depending on the severity (Yasukawa and Searcy 1995). Rich et al. (2004) estimated the statewide breeding population at 17,000 blackbirds. Trend data from the BBS indicates the number of red-winged blackbirds observed in the State during the breeding season has shown a declining trend since 1966 estimated at -3.3% annually (Sauer et al. 2012). More recent trend data from 2001 through 2011 also indicates a downward trend estimated at -3.4% annually (Sauer et al. 2012). Across all survey routes in the New England/Mid-Atlantic Coast Region, the number of red-winged blackbirds observed has shown downward trends since 1966 estimated at -1.9% annually (Sauer et al. 2012).

The number of red-winged blackbirds observed during the CBC in the State has shown a variable trend since 1966, with a general overall increasing trend (NAS 2010); however, only a small number of blackbirds are observed annually in areas surveyed in the State during the CBC. Most blackbirds migrate from the State during the winter (Yasukawa and Searcy 1995). BirdLife International (2012) ranks the red-winged blackbird as a species of least concern.

Outside of the nesting season, blackbirds generally feed and roost in flocks varying from a few birds to over a million birds (Dolbeer 1994). Feeding flocks and roosting congregations are sometimes comprised of a single species, but often several species are mixed together. In Rhode Island, winter flocks are often composed of birds and migrants from Canada and the northern United States along with birds that are present in the State throughout the year. The tendency of blackbirds and starlings to form large communal roosts in agricultural producing areas of the State and to travel and feed in large social flocks often results in locally serious damage to crops. Monetary losses to individual agricultural producers can be substantial (Glahn and Wilson 1992). Accumulations of fecal droppings under areas where large congregations of blackbirds and starlings roost, loaf, or feed can cause damage to or pose threats of damage to a variety of resources in Rhode Island. Damages or threats of damage from accumulations of fecal droppings could occur at dairies and livestock feedlots (*e.g.*, consumption and contamination of feed). Accumulations of fecal droppings can damage buildings and other property (*e.g.*, damage to structures from the acid in fecal droppings) and pose disease risks to people and animals (*e.g.*, fecal droppings in public use areas). In addition, large flocks of blackbirds and accumulations of fecal droppings can be aesthetics displeasing (*e.g.*, noise, smell). Requests for assistance associated with blackbirds are most likely to occur during the migration periods when blackbirds congregate in large flocks.

As discussed in Chapter 1, the USFWS has established a depredation order (see 50 CFR 21.43) for blackbirds. Under the order, a depredation permit is not required to remove blackbirds if they are committing or about to commit depredations upon ornamental or shade trees, agricultural crops, livestock, or wildlife, or when concentrated in such numbers and manner as to constitute a health hazard or other nuisance. Since a depredation permit is not required for the take of red-winged blackbirds, the number taken annually has not previously been reported to the USFWS. Therefore, the annual take of red-winged blackbirds to alleviate damage or threats of damage under the depredation order in previous years is unknown.

Between FY 2006 and FY 2012, WS has dispersed 275 red-winged blackbirds to alleviate damage or threats of damage in the State. WS has not previously employed lethal methods to address damage or threats of damage caused by red-winged blackbirds. In anticipation of receiving requests for assistance, WS could take up to 500 red-winged blackbirds annually under the proposed action alternative to alleviate damage. With an estimated breeding population of 17,000 blackbirds in the State, take of up to 500 red-winged blackbirds would represent 2.9% of the population. Since a depredation permit is not required for the take of red-winged blackbirds, the number taken annually previously was not reported to

the USFWS. Therefore, the annual take of red-winged blackbirds to alleviate damage or threats of damage under the depredation order is currently unknown.

European Starling Biology and Population Impact Analysis

Colonization of North America by the European starling began on March 6, 1890 when a member of the Acclimatization Society released 80 starlings into Central Park in New York. The released starlings were able to exploit the habitat resources in the area and were able to become established in the area. By 1918, the range of migrant juveniles extended from Ohio to Alabama. By 1926, the distribution of starlings in the United States had moved westward and encompassed an area from Illinois to Texas. By 1941, further westward expansion had occurred and starlings were known to occur and breed from Idaho to New Mexico. By 1946, the range of starlings had expanded to California and western Canadian coasts (Miller 1975). In just 50 years, the starling had colonized the United States and expanded into Canada and Mexico and 80 years after the initial introduction had become one of the most common birds in North America (Feare 1984). Today, starlings can be found throughout the State and are considered common permanent residents.

Precise counts of starling populations do not exist but one estimate placed the nationwide starling population at an estimated 140 million birds (Johnson and Glahn 1994). According to Linz et al. (2007), European starlings are prolific with nest success rates estimated between 48% and 79% (Kessel 1957, Royall 1966), although only about 20% of nestlings survive to reproduce (Kessel 1957). Adult survival is believed to be significantly higher, around 60% (Flux and Flux 1981). Based on these mortality estimates, approximately 80% of the young of the year and 40% of adult starlings die each year due to natural and human causes.

From 1966 through 2011, the number of starlings observed along routes surveyed during the BBS has shown a declining trend in the State estimated at -4.9% annually, with a -5.0% decline occurring annually from 2001 through 2011 (Sauer et al. 2012). Using data from the BBS, Rich et al. (2004) estimated the statewide breeding population of starlings at 60,000 birds. Across all routes surveyed in the United States during the BBS, the number of starlings observed has shown a declining trend estimated at a rate of -1.0% annually from 1966 through 2011 (Sauer et al. 2012). The number of starlings observed in those areas surveyed during the CBC in the State has shown a general overall declining trend from 1966 through 2011 (NAS 2010).

Starlings are not native to Rhode Island and are afforded no protection under the MBTA or any State law. Therefore, a depredation permit from the USFWS or the State is not required to remove starlings to alleviate damage or threats of damage. Since the take of starlings to alleviate damage or threats of damage is not reported to the USFWS or the MDIFW, the lethal take of starlings in the State to alleviate damage or threats of damage by entities other than WS is unknown.

Based on the flocking behavior of starlings and the potential for damage or threats of damage to arise from that behavior, WS anticipates that up to 20,000 starlings could be lethally taken annually in the State to alleviate damage or threats of damage. In addition, up to 500 starling nests, including eggs, could be destroyed annually. Between FY 2006 and FY 2012, WS has responded to requests for assistance to reduce starling damage, primarily using non-lethal dispersal methods. Since FY 2006, WS has dispersed 8,793 starlings and employed lethal methods to remove 301 starlings. In anticipation of receiving requests for assistance to manage damage and threats associated with a large starling roost, take of up to 20,000 starlings could occur despite the limited take that has occurred since FY 2006. The take of 20,000 starlings would represent 33.3% of the estimated 60,000 starlings breeding in the State. However, most requests to address large roosts occur during the migration periods and during the winter when the population in the State likely increases above the 60,000 starlings estimated to nest in the State. The

increase in the population would be a result of the arrival of migrants into the State and the presence of juveniles in the population.

Executive Order 13112 states that each federal agency shall reduce invasions of exotic species and reduce the associated damages to the extent practicable and permitted by law. WS' take of European starlings to reduce damage and threats would comply with Executive Order 13112.

Common Grackle Biology and Population Impact Analysis

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

Common grackles can be found throughout the year in Rhode Island (Peer and Bollinger 1997). Rich et al. (2004) estimated the breeding population to be 30,000 grackles. The number of common grackles observed along routes surveyed during the BBS has shown a declining trend since 1966, which has been estimated at -2.0% annually (Sauer et al. 2012). Between 2001 and 2011, the number grackles observed during the BBS has shown a declining trend estimated at -2.1% annually (Sauer et al. 2012). A downward trend has also been observed for grackles observed along BBS routes across the New England/Mid-Atlantic Coast Region, which has been estimated at -2.1% annually since 1966 (Sauer et al. 2012). Across the United States, the number of common grackles observed during the annual BBS has also shown a downward trend estimated at -1.7% since 1966 (Sauer et al. 2012). BirdLife International (2012) ranks the common grackle as a species of least concern.

Grackles can form large flocks during the migration periods. A flock of over 25,000 grackles was observed by WS' personnel in nearby eastern Connecticut during January of 2012 (T. Cozine, WS, personal observation 2012). The number of grackles observed in the State during the annual CBC surveys has shown a general increasing trend since 1966 (NAS 2010); however, relatively few grackles are observed in areas surveyed during the CBC within the State during some survey years since most grackles migrate through Rhode Island to wintering areas further south.

The open areas found at airports makes the habitat ideal for flocks of foraging grackles during fall and winter and forest and wetland areas on or adjacent to airports provide nest sites an foraging sites during the spring and summer. Most requests for assistance to reduce threats associated with grackles occur at airports in Rhode Island. However, flocks of grackles can consume and contaminate livestock feed and damage ripening corn. In neighboring Massachusetts, WS regularly receives complaints during the breeding season of nesting grackles dropping fecal sacs into swimming pools that have been removed from the nest. Young grackles excrete waste encased in gelatinous sacs, an adaptation that promotes a clean nest. Grackles dispose of the fecal sacs of their young into the closest body of water (Massachusetts Audubon 2012). This is done to reduce the attraction to ground based predators such as raccoons, fishers,

and snakes that could be cued to the presence of chicks if the droppings simply accumulated on the ground beneath the nest.

Between FY 2006 and FY 2012, WS has responded to requests for assistance to reduce grackle damage using non-lethal dispersal methods. Since FY 2006, WS has dispersed 164 starlings with no lethal removal of grackles occurring by WS. Based on previous requests for assistance and in anticipation of additional efforts, WS could be requested to employ lethal methods to take up to 1,000 common grackles annually. Like other blackbird species, the take of common grackles can occur under the blackbird depredation order, which allows blackbirds, including common grackles, to be taken when committing damage or about to commit damage without the need for a depredation permit from the USFWS. Therefore, the number of common grackles taken annually by other entities in the State has been unknown.

If up to 1,000 common grackles were taken annually by WS, the take would represent 3.3% of the estimated 30,000 common grackles breeding within the State. The take of common grackles by other entities is expected to be of low magnitude when compared to the statewide estimated breeding population in Rhode Island.

Brown-headed Cowbird Biology and Population Impact Analysis

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

In Rhode Island, the number of cowbirds observed in areas surveyed during the BBS has shown an increasing trend estimated at 1.5% annually between 1966 and 2011 (Sauer et al. 2012). From 2001 through 2011, the number of cowbirds observed in the State has shown an increasing trend estimated at 2.0% annually (Sauer et al. 2012). The breeding population of cowbirds in the State has been estimated at 5,000 cowbirds (Rich et al. 2004). In the New England/Mid-Atlantic Coast Region, cowbirds have shown an increasing trend since 1966 estimated at 0.3%, annually, with a 0.6% annual decline occurring from 2001 through 2011 (Sauer et al. 2012). Across all BBS routes surveyed in the United States since 1966, the number of cowbirds observed has shown a declining trend estimated at -0.3% annually; however, from 2001 through 2011, the number of cowbirds observed has shown an increasing trend estimated at 0.7% annually (Sauer et al. 2012). The number of cowbirds observed during the CBC conducted annually in the State has shown a downward trend since 1966 (NAS 2010). BirdLife International (2012) ranks the brown-headed cowbird as a species of least concern.

Between FY 2006 and FY 2012, WS has employed non-lethal methods to disperse 167 cowbirds to alleviate damage or threats of damage. WS has not employed lethal methods previously to address

damage or threats of damage associated with cowbirds. Since cowbirds could be present in mixed species flocks of blackbirds, WS could lethally remove up to 500 cowbirds annually in the State to alleviate damage or threats of damage. Like other blackbird species, the take of cowbirds can occur pursuant to the blackbird depredation order without the need for a depredation permit from the USFWS; therefore, the number of cowbirds taken annually by other entities to alleviate damage or threats of damage in the State is currently unknown. However, the take of cowbirds by other entities to alleviate damage or threats is likely non-existent to minimal in the State. The take of brown-headed cowbirds by other entities is expected to be of low magnitude when compared to the statewide estimated population for Rhode Island.

Based on a statewide breeding population estimated at 5,000 cowbirds (Rich et al. 2004), take of up to 500 cowbirds by WS to alleviate damage or threats of damage would represent 10.0% of the estimated breeding population. Take of cowbirds by other entities to alleviate damage or threats of damage, under the blackbird depredation order, would not likely reach a level where cumulative adverse effects to the species' population would occur. Although cowbirds can cause damage or pose threats of damage, most take of cowbirds by WS would be the result of addressing flocks of mixed species flocks of blackbirds. That take is not likely to reach a level where adverse effects on the species' population would occur and would be of low magnitude when compared to the statewide population of cowbirds and trend data.

Additional Target Bird Species

Limited numbers of additional target species have been addressed previously by WS or WS anticipates addressing a limited number of additional species under the proposed action alternative. Those species would primarily be addressed to alleviate aircraft strike risks at airports. Strike risks associated with those species often occur infrequently or involve only a few individuals. Those species that could be addressed by WS in limited numbers, after receiving a request for assistance associated with those species, would include snow geese, brant, wood ducks, gadwalls, American wigeons, blue-winged teal, Northern shovelers, Northern pintails, green-winged teal, canvasbacks, redheads, ring-necked ducks, greater scaup, lesser scaup, common eiders, surf scoters, white-winged scoters, black scoters, long-tailed ducks, buffleheads, common goldeneyes, hooded mergansers, common mergansers, red-breasted mergansers, ruddy ducks, feral/free ranging waterfowl, Northern bobwhite, ring-necked pheasants, ruffed grouse, common loons, pied-billed grebes, horned grebes, red-necked grebes, great egrets, snowy egrets, little blue herons, cattle egrets, green herons, yellow-crowned night-herons, glossy ibises, Northern harriers, sharp-shinned hawks, Cooper's hawks, Northern goshawks, Swainson's hawks, rough-legged hawks, American kestrels, merlins, peregrine falcons, American coots, black-bellied plovers, American golden plovers, semipalmated plovers, killdeer, American oystercatchers, spotted sandpipers, solitary sandpipers, greater yellowlegs, willets, lesser yellowlegs, upland sandpipers, whimbrels, ruddy turnstones, sanderlings, semipalmated sandpipers, Western sandpipers, least sandpipers, white-rumped sandpipers, pectoral sandpipers, purple sandpipers, dunlins, buff-breasted sandpipers, short-billed dowitchers, long-billed dowitchers, American woodcocks, Wilson's snipe, Iceland gulls, lesser black-backed gulls, glaucus gulls, least terns, common terns, barn owls, Eastern screech owls, great horned owls, snowy owls, barred owls, long-eared owls, short-eared owls, Northern saw-whet owls, common nighthawks, Eastern whip-poor-wills, chimney swifts, belted kingfishers, red-headed woodpeckers, red-bellied woodpeckers, yellow-bellied sapsuckers , downy woodpeckers, hairy woodpeckers, Northern flickers, pileated woodpeckers, Eastern phoebes, Eastern kingbirds, Northern shrikes, blue jays, common ravens, horned larks, purple martins, cliff swallows, black-capped chickadees, tufted titmice, red-breasted nuthatches, white-breasted nuthatches, brown creepers, house wrens, Eastern bluebirds, American robins, gray catbirds, Northern mockingbirds, cedar waxwings, dark-eyed juncos, lark buntings, grasshopper sparrows, chipping sparrows, savannah sparrows, Northern cardinals, Eastern meadowlarks, purple finches, house finches, and American goldfinches.

Based on previous requests for assistance and the take levels necessary to alleviate those requests for assistance or in anticipation of the need to address those species, no more than 20 individuals of any of those species could be lethally removed annually by WS in the State, except peregrine falcons. WS would only address peregrine falcons causing damage or posing a threat of damage using non-lethal dispersal methods. In addition, up to 10 nests of those species, except peregrine falcons, could be destroyed annually by WS in the State to alleviate damage or discourage nesting in areas where damages were occurring. Those species are not expected by WS to be taken at any level that would adversely affect populations of those species. Most of those birds listed are afforded protection from take under the MBTA and the take would only be allowed through the issuance of a depredation permit and only at those levels stipulated in the permit, except for free-ranging/feral waterfowl, Northern bobwhite, ring-necked pheasant, and ruffed grouse. Therefore, those birds listed under the MBTA would be taken in accordance with applicable state and federal laws and regulations authorizing take of migratory birds and their nests and eggs, including the USFWS and the RIDEM permitting processes. The USFWS and the RIDEM, as the agencies with management responsibility for migratory birds, could impose restrictions on depredation take as needed to assure cumulative take does not adversely affect the continued viability of populations. This would assure that cumulative impacts on those bird populations would have no significant adverse effect on the quality of the human environment. In addition, any take of the above species in accordance with an issued federal and state permit would be reported to the USFWS and the RIDEM annually. Northern bobwhite, ring-necked pheasants, and ruffed grouse are species managed by the RIDEM and any take would occur pursuant to permits issued, when necessary.

Feral or free-ranging domestic waterfowl are not afforded protection under the MBTA and are considered non-native species or livestock in Rhode Island. The take of feral or free-ranging waterfowl can occur without the need for a depredation permit from the USFWS and the RIDEM. However, in most situations, WS would consult with the RIDEM before lethally removing feral/free-ranging domestic waterfowl. Exceptions could include, but not be limited to, when ducks or geese were on airport property or if they were located on the property of the individual requesting assistance. The lethal removal of feral or free-ranging domestic waterfowl would not be expected to reach a level where the populations of those species would be adversely affected by WS' activities under the proposed action. However, because they are non-native, any lethal removal of feral or free-ranging domestic waterfowl could be considered as providing some benefit to the natural environment.

Snow geese, brant, wood ducks, gadwalls, American wigeons, blue-winged teal, Northern shovelers, Northern pintails, green-winged teal, canvasbacks, redheads, ring-necked ducks, greater scaup, lesser scaup, common eiders, surf scoters, white-winged scoters, black scoters, long-tailed ducks, buffleheads, common goldeneyes, hooded mergansers, common mergansers, red-breasted mergansers, ruddy ducks, Northern bobwhite, ring-necked pheasants, ruffed grouse, American coots, American woodcocks, and Wilson's snipe maintain sufficient population densities to allow for annual harvest seasons. The proposed take of up to 20 individuals of those species, including up to 10 nests, under the proposed action would be a minor component of the annual take of those species during the regulated hunting seasons.

The species of birds that could be addressed by WS in limited numbers under the proposed action that have been designated as threatened, endangered, or a species of concern by the RIDEM include the pied-billed grebe, great egret, little blue heron, snowy egret, cattle egret, yellow-crowned night-heron, green-winged teal, blue-winged teal, gadwall, hooded merganser, northern harrier, sharp-shinned hawk, Cooper's hawk, northern goshawk, peregrine falcon, willet, upland sandpiper, least tern, barn owl, long-eared owl, Northern saw-whet owl, common nighthawk, pileated woodpecker, cliff swallow, grasshopper sparrow, and dark-eyed junco. For bird species, listing by the RIDEM is based on the status of breeding populations in Rhode Island.

The complete list of the State listed wildlife in Rhode Island is listed in Appendix C. None of those species that could be addressed by WS under the proposed action alternative that are listed as threatened, endangered, or a species of concern by the RIDEM are federally listed as threatened or endangered by the USFWS pursuant to the ESA.

State-listed species are separated into four categories: State-designated Threatened, State-designated Endangered, State-designated Historical, and State-designated Species of Special Concern. State designations and their definitions are listed below:

State-designated Endangered is a native species in imminent danger of extirpation from Rhode Island. These species may meet one or more of the following criteria (1) formerly considered by the USFWS for federal listing as endangered or threatened, (2) known from an estimated one to two total populations in the State, and (3) apparently globally rare or threatened; estimated at 100 or fewer populations range-wide. The breeding populations of pied-billed grebes, northern harrier, peregrine falcon, upland sandpipers, and barn owls have been listed by the RIDEM as State-designated Endangered.

State-designated Threatened is any native species that is likely to become State-designated Endangered in the future if current trends in habitat loss or other detrimental factors remain unchanged. In general, these species have three to five known or estimated populations and are especially vulnerable to habitat loss. The breeding populations of least terns and grasshopper sparrows have been listed as State-designated Threatened by the RIDEM.

State-designated Species of Concern are any native species not considered State-designated Endangered or State-designated Threatened now, but are listed due to various factors of rarity and/or vulnerability. Species listed in this category may warrant endangered or threatened designation, but status information is presently not well known. The breeding populations of great egrets, little blue herons, snowy egrets, cattle egrets, yellow-crowned night-herons, green-winged teal, blue-winged teal, gadwall, hooded mergansers, Cooper's hawks, Northern goshawks, willet, long-eared owls, Northern saw-whet owls, common nighthawks, pileated woodpeckers, and dark-eyed juncos have been designated by the RIDEM as State-designated Species of Concern.

State-designated Historical includes any native species that have been documented for the State during the last 100 years, but which are currently unknown to occur. The breeding populations of sharp-shinned hawks and cliff swallows have been listed as State-designated Historical by the RIDEM.

WS anticipates using primarily non-lethal harassment methods to address those species to alleviate damage or threats of damage. Non-lethal harassment methods employed to disperse those species would not result in adverse effects, since those species would be unharmed. However, WS could be requested to lethal remove individuals of those species listed as State-designated Endangered, State-designated Threatened, State-designated Historical, and State-designated Species of Concern on a limited basis, except for peregrine falcons. The lethal removal of those species would only occur by WS when permitted by the USFWS and only at take levels allowed under those depredation permits and only when authorized by the RIDEM. WS would not lethally removing more than five individuals annually of any of those species listed by the RIDEM as State-designated Endangered, State-designated Threatened, State-designated Historical, or State-designated Species of Concern during the breeding season. The breeding season for those species would generally occur from March to August each year in the State. In addition, up to two nests of each species, except peregrine falcons, could be destroyed by WS annually to alleviate damage and discourage nesting in areas where damages or threats were occurring. The permitting of the take by the USFWS and the RIDEM would ensure the lethal removal of those species occurred within population management objectives and removal was conducted pursuant to federal and state laws and regulations.

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.[19] Current information on disease distribution and knowledge of the mixing of birds in migratory flyways has been used to develop a prioritized sampling approach based on the major North American flyways. Surveillance data from all of those areas would be incorporated into national risk assessments, preparedness, and response planning to reduce the adverse impacts of a disease outbreak in wild birds, poultry, or humans.

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

Investigation of Illness/Death in Birds: A systematic investigation of illness and death in wild birds may be conducted to determine the cause of the illness or the cause of death in birds. This strategy offers the best and earliest probability of detection if a disease is introduced by migratory birds into the United States. Illness and death involving wildlife are often detected by, or reported to natural resource agencies and entities. This strategy capitalizes on existing situations of birds without additional birds being handled or killed.

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

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

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

Environmental Sampling: Many avian diseases are released by waterfowl through the intestinal tract and can be detected in both feces and the water in which the birds swim, defecate, and feed. This is the principal means of virus spread to new birds and potentially to poultry, livestock, and humans. Analysis

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

of water and fecal material from certain habitats can provide evidence of diseases circulating in wild bird populations, the specific types of diseases, and pathogenicity. Monitoring of water and/or fecal samples gathered from habitat would be a reasonably cost effective, technologically achievable means to assess risks to humans, livestock, and other wildlife.

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

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

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

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

Despite no direct involvement by WS in resolving damage and threats associated with birds in the State, those persons experiencing damage caused by birds could continue to alleviate damage by employing those methods legally available. Under this alternative, those persons experiencing threats or damage associated with birds in the State could lethally take birds. In order for the property owner or manager to use lethal methods, they must apply for their own depredation permit to take birds from the USFWS and the RIDEM, when required. Technical assistance could also be provided by WS as part of the application process for issuing a depredation permit by the USFWS under this alternative, when deemed appropriate. WS could evaluate the damage and complete a Migratory Bird Damage Report for the requester, which would include information on the extent of the damages, the number of birds present, and a recommendation for the number of birds that should be taken to best alleviate the damages. Following USFWS review of a complete application for a depredation permit from a property owner or manager and the Migratory Bird Damage Report, a depredation permit could be issued to authorize the lethal take of a specified number of each bird species.

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

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

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

Alternative 3 – No Bird Damage Management Conducted by WS

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

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

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

Under this alternative, property owners/managers may have difficulty obtaining permits to use lethal methods. The USFWS needs professional recommendations on individual damage situations before issuing a depredation permit for lethal take, and the USFWS does not have the mandate or the resources to conduct damage management activities. State agencies with responsibilities for migratory birds would likely have to provide this information if depredation permits were to be issued. If the information were provided to the USFWS, following the agency's review of a complete application package for a

depredation permit from a property owner or manager to take birds lethally, the permit issuance procedures would follow that described in Alternative 1 and Alternative 2.

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

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

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

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

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

Personnel from WS would be experienced and trained in wildlife identification to select the most appropriate methods for taking targeted animals and excluding non-target species. To reduce the likelihood of capturing non-target wildlife, WS would employ the most selective methods for the target species, would employ the use of attractants that are as specific to target species as possible, and determine placement of methods to avoid exposure to non-targets. SOPs to prevent and reduce any potential adverse impacts on non-targets are discussed in Chapter 3 of this EA. Despite the best efforts to minimize non-target take during program activities, the potential for adverse effects to non-targets exists when applying both non-lethal and lethal methods to manage damage or reduce threats to safety.

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

Other non-lethal methods available for use under this alternative include live traps, nets, nest destruction, translocation, and repellents. Live traps (*e.g.*, cage traps, walk-in traps, decoy traps) and nets (*e.g.*,

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

Nets could include the use of net guns, net launchers, cannon/rocket nets, drop nets, bow nets, dipping nets, and mist nets. Nets are virtually selective for target individuals since application would occur by attending personnel, with handling of wildlife occurring after deployment of the net or nets would be checked frequently to address any live-captured wildlife. Therefore, any non-targets captured using nets could be immediately released on site. Any potential non-targets captured using non-lethal methods would be handled in such a manner as to ensure the survivability of the animal if released. Even though live-capture does occur from those methods, the potential for death of a target or non-target animal while being restrained or released does exist, primarily from being struck by the net gun/launcher weights, or cannon/rocket assemblies during deployment. The likelihood of non-targets being struck is extremely low and is based on being present when the net is activated and in a position to be struck. Nets are positioned to envelop wildlife upon deployment and to minimize striking hazards. Baiting of the areas to attract target species often occurs when using nets. Therefore, sites can be abandoned if non-target use of the area is high.

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

Only those repellents registered with the EPA pursuant to the FIFRA and registered for use in the State would be recommended and used by WS under this alternative. Therefore, the use and recommendation of repellents would not have negative effects on non-target species when used according to label requirements. Most repellents for birds, except for Avitrol and mesurol, are derived from natural ingredients that pose a very low risk to non-targets when exposed to or when ingested.

Two chemicals commonly registered with the EPA as bird repellents are methyl anthranilate and anthraquinone. Methyl anthranilate naturally occurs in grapes. Methyl anthranilate has been used to flavor food, candy, and soft drinks. Anthraquinone naturally occurs in plants, like aloe. Anthraquinone has been used to make dye. Both products claim to be unpalatable to many bird species. Several products are registered for use to reduce bird damage containing either methyl anthranilate or anthraquinone. Formulations containing those chemicals are liquids that are applied directly to susceptible resources. Methyl anthranilate applied to alleviate goose damage was effective for about four days depending on environmental conditions, which was a similar duration experienced when applying anthraquinone as geese continued to feed on treated areas (Cummings et al. 1995, Dolbeer et al. 1998). Dolbeer et al. (1998) found that geese tended to loaf on anthraquinone treated turf, albeit at lower abundance, but the quantity of feces on treated and untreated turf was the same, thus the risk of damage was unabated. Mesurol is applied directly inside eggs that are of a similar appearance to those being

predated on by crows. Therefore, risks to non-target would be restricted to those wildlife species that would select for the egg baits. However, adherence to the label requirements of mesurol would ensure threats to non-targets would be minimal. Similarly, when used in accordance with the label requirements, the use of Avitrol would also not adversely affect non-targets based on restrictions on baiting locations.

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

Since products containing the active ingredient nicarbazin could be commercially available and purchased by people with a certified applicators license, the use of the product could occur under any of the alternatives discussed in the EA; therefore, the effects of the use would be similar across all the alternatives if the product were used according to label instructions. Under the proposed action, WS could use or recommend products containing nicarbazin as part of an integrated approach to managing damages associated with geese, domestic waterfowl, and pigeons, if products were registered for use in Rhode Island. A product containing the active ingredient nicarbazin is currently registered in the State to manage local pigeon populations. Products containing nicarbazin are not currently registered in the State for use to manage local goose and domestic waterfowl populations. WS' use of nicarbazin under the proposed action would not be additive since the use of the product could occur from other sources, such as private pest management companies or those people experiencing damage could become a certified applicator and apply the bait themselves when the appropriate depredation permits were received[20].

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

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

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

excretion of the two components of nicarbazin (DNC and HDP) in birds, non-targets birds would have to consume nicarbazin daily at sufficient doses to reduce the rate of egg hatching.

Secondary hazards also exist from wildlife consuming geese, domestic waterfowl, or pigeons that have ingested nicarbazin. As mentioned previously, once consumed, nicarbazin is rapidly broken down into the two base components DNC and HDP. DNC is the component of nicarbazin that limits egg hatchability while HDP only aids in absorption of DNC into the bloodstream. DNC is not readily absorbed into the bloodstream and requires the presence of HDP to aid in absorption of appropriate levels of DNC. Therefore, to pose a secondary hazard to wildlife, ingestion of both DNC and HDP from the carcass would have to occur and HDP would have to be consumed at a level to allow for absorption of the DNC into the bloodstream. In addition, an appropriate level of DNC and HDP would have to be consumed from a carcass daily to produce any negative reproductive affects to other wildlife since current evidence indicates a single dose does not limit reproduction. To be effective, nicarbazin (both DNC and HDP) must be consumed daily during the duration of the reproductive season to limit the hatchability of eggs. Therefore, to experience the reproductive affects of nicarbazin, geese, domestic waterfowl, or pigeons that had consumed nicarbazin would have to be consumed by a non-target species daily and a high enough level of DNC and HDP would have to be available in the carcass and consumed for reproduction to be affected. Based on the risks and likelihood of wildlife consuming a treated carcass daily and receiving the appropriate levels of DNC and HDP daily to negatively impact reproduction, secondary hazards to wildlife from the use of nicarbazin are extremely low (EPA 2005).

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

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

WS would also employ and/or recommend lethal methods under the proposed action alternative to alleviate damage. Lethal methods available for use to manage damage caused by birds under this alternative would include shooting, lethal traps, and DRC-1339. In addition, birds could also be euthanized once live-captured by other methods. Available methods and the application of those methods to alleviate bird damage is further discussed in Appendix B. In addition, birds could still be lethally taken during the regulated harvest season, through depredation/control orders, and through the issuance of depredation permits under this alternative.

The use of firearms would essentially be selective for target species since animals would be identified prior to application; therefore, no adverse effects to non-targets would be anticipated from use of this method. The euthanasia of birds by WS' personnel would be conducted in accordance with WS Directive 2.505. Chemical methods used for euthanasia would be limited to carbon dioxide administered in an enclosed chamber after birds were live-captured. Since live-capture of birds using other methods would occur prior to the administering of carbon dioxide, no adverse effects to non-targets would occur under

this alternative. WS' recommendation that birds be harvested during the regulated season by private entities to alleviate damage would not increase risks to non-targets. Shooting would essentially be selective for target species and the unintentional lethal removal of non-targets would not likely increase based on WS' recommendation of the method.

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

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

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

The median acute lethal dose (LD_{50})[21] values for starlings, blackbirds, and magpies (Corvidae) range from one to five mg/kg (Eisemann et al. 2003). For American crows, the median acute lethal dose has been estimated at 1.33 mg/kg (DeCino et al. 1966). The acute oral toxicity (LD_{50}) of DRC-1339 has been estimated for over 55 species of birds (Eisemann et al. 2003). DRC-1339 is toxic to mourning doves, pigeons, quail (*Coturnix coturnix*), chickens and ducks (*Anas* spp.) at ≥5.6 mg/kg (DeCino et al. 1966). In cage trials, Cummings et al. (1992) found that 2% DRC-1339-treated rice did not kill savannah sparrows (*Passerculus sandwichensis*). Gallinaceous birds and waterfowl may be more resistant to DRC-1339 than blackbirds, and their large size may reduce the chances of ingesting a lethal dose (DeCino et al. 1966). Avian reproduction does not appear to be affected from ingestion of DRC-1339 treated baits until levels are ingested where toxicity is expressed (USDA 2001).

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

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

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

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

DRC-1339 Secondary Hazards - Secondary poisoning has not been observed with DRC-1339 treated baits. During research studies, carcasses of birds that died from DRC-1339 were fed to raptors and scavenger mammals for 30 to 200 days with no symptoms of secondary poisoning observed (Cunningham et al. 1979). This can be attributed to relatively low toxicity to species that might scavenge on blackbirds killed by DRC-1339 and its tendency to be almost completely metabolized in the target birds, which leaves little residue to be ingested by scavengers.

DRC-1339 is rapidly metabolized and excreted and does not bioaccumulate, which probably accounts for its low secondary hazard profile (Schafer, Jr. 1991). For example, cats, owls and magpies would be at risk only after exclusively eating DRC-1339-poisoned starlings for 30 continuous days (Cunningham et al. 1979). According to the EPA (1995), laboratory studies with raptors indicated no adverse effects when certain raptor species were fed starlings poisoned with 1% DRC-1339 treated baits. Two American kestrels survived eating 11 and 60 poisoned starlings over 24 and 141 days, respectively. Two Cooper's hawks ate 191 and 222 starlings with no observable adverse effects. Three Northern harriers ate 100, 191, and 222 starlings over 75 to 104 days and survived with no apparent detrimental effects. The LD_{50} values established for other avian predators and scavengers such as crows, ravens, and owls indicate these species are acutely more sensitive to DRC-1339 than hawks and kestrels (EPA 1995). The risk to mammalian predators from feeding on birds killed with DRC-1339 appears to be low (Johnston et al. 1999).

The risks associated with non-target animal exposure to DRC-1339 baits have been evaluated in rice fields in Louisiana (Glahn et al. 1990, Cummings et al. 1992, Glahn and Wilson 1992), poultry and cattle feedlots in several western states (Besser 1964, Ford 1967, Royall et al. 1967), ripening sunflower fields in North Dakota (Linz et al. 2000), and around blackbird staging areas in east-central South Dakota (Knutsen 1998, Linz et al. 1999, Smith 1999). Smith (1999) used field personnel and dogs to search for dead non-target animals around sites baited with DRC-1339. Smith (1999) did not find carcasses of non-targets that exhibited histological signs consistent with DRC-1339 poisoning. Other studies also failed to

detect any non-target birds that had succumbed to DRC-1339. However, DRC-1339 is a slow-acting avicide and thus, some birds could move to areas not searched by the study participants before dying.

DRC-1339 Environmental Degradation - DRC-1339 is unstable in the environment and degrades rapidly when exposed to sunlight, heat, or ultra violet radiation and has a short half-life (EPA 1995). DRC-1339 is highly soluble in water but does not hydrolyze and degradation occurs rapidly in water. The chemical tightly binds to soil and has low mobility. The half-life is about 25 hours, which means it is nearly 100% broken down within a week, and identified metabolites (*i.e.*, degradation chemicals) have low toxicity.

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

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

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

While every precaution would be taken to safeguard against taking non-targets during operational use of methods and techniques for resolving damage and reducing threats caused by birds, the use of such methods can result in the incidental take of unintended species. Those occurrences would be rare and should not affect the overall populations of any species under the proposed action. WS' take of non-target species during activities to reduce damage or threats to human safety associated with birds in Rhode Island is expected to be extremely low to non-existent. Non-targets have not been lethally removed by WS during prior activities target birds in the State. WS would monitor the take of non-target species to ensure program activities or methodologies used in bird damage management do not adversely affect non-targets. Methods available to alleviate and prevent bird damage or threats when employed by trained, knowledgeable personnel are selective for target species. WS would annually report to the USFWS and/or the RIDEM any non-target take to ensure take by WS is considered as part of

management objectives established. The potential impacts to non-targets are similar to the other alternatives and are considered minimal to non-existent.

The proposed bird damage management could benefit many other wildlife species that were adversely affected by predation or competition for resources. For example, crows are generally very aggressive nesting area colonizers and they will force other species from those 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 establishment of special restrictions or mitigation measures. SOPs to avoid T&E effects are described in Chapter 3 of this EA.

Federally Listed Species - The current list of species designated as threatened and endangered in Rhode Island as determined by the USFWS and the National Marine Fisheries Services was obtained and reviewed during the development of this EA. Appendix C contains the list of species currently listed in the State along with common and scientific names.

The New England Field Office (NEFO) of the USFWS has developed a website[22] that provides up-to-date species occurrence information and provides an outline for action agencies to assist in determining whether informal or formal consultation for projects would be required under Section 7 of the ESA. After consulting with the NEFO, a determination was made that WS would review the NEFO website, or WS would contact the NEFO directly, on a project-by-project basis, to determine if federally listed T&E species could be present in the area of potential projects prior to activities being conducted. If, according to information provided on the website or through direct communication, there were no known instances of a listed species being present in the project area, or if the species would not be present during the period the project was to be conducted, a "*no effect*" determination would be made by WS and the project could proceed. A "*No Species Present*" letter stating, "*no species are known to occur in the project area*" would be generated from the website (see Appendix D) and included with the project file. If listed species could be present in a project area, WS would consult with the NEFO to determine if listed species were present or if listed species could reasonably be expected to be in the project area. If the determination that listed species do not occur in the project area or during the period the project would be conducted, a "*no effect*" determination would be made and the project could proceed.

If T&E species were present or if species could reasonably be expected to be in a project area during the period the project would be conducted, WS would contact with the NEFO, and if necessary, conduct the appropriate informal or formal Section 7 consultation based on discussions with the NEFO. Any mitigation measures recommended by the NEFO during the consultation process would be implemented to reduce or eliminate threats to T&E species.

State Listed Species – The current list of State listed species designated as endangered, threatened, historical, or a species of concern, as determined by the RIDEM, was obtained and reviewed during the

[22] The New England Field Office website for endangered species consultation could be found at http://www.fws.gov/newengland/EndangeredSpec-Consultation_Project_Review.htm during the development of this EA

development of the EA (see Appendix C). Based on the review of species listed in the State, WS has determined that the proposed activities would not adversely affect those bird species currently listed by the State and would have no effect on other species listed by the RIDEM in the State. Any activity involving State listed bird species being analyzed in this EA would require prior authorization by the USFWS and the RIDEM through permitting. The permitting of any take by the RIDEM involving a State-designated species would ensure activities conducted by WS would not adversely affect the status of bird species listed as endangered, threatened, historical, or of special concern.

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

Under a technical assistance alternative, WS would have no direct impact on non-target species, including T&E species. Methods recommended or provided through loaning of equipment could be employed by those people requesting assistance. Recommendations would be based on WS' Decision Model using information provided by the person requesting assistance or through site visits. Recommendations would include methods or techniques to minimize non-target impacts associated with the methods being recommended or loaned. Methods recommended could include non-lethal and lethal methods as deemed appropriate by WS' Decision Model and as permitted by laws and regulations. The only methods that would not be available under a technical assistance only alternative would include DRC-1339, alpha chloralose, and mesurol, which would only be available to for use by WS' employees.

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

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

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

If requestors were provided technical assistance but do not implement any of the recommended actions and take other actions, the potential impacts to non-targets could be higher compared to the proposed action. If those people requesting assistance implement recommended methods appropriately and as instructed or demonstrated, the potential impacts to non-targets would be similar to the proposed action. Methods or techniques that were not implemented as recommended or were used inappropriately would likely increase potential impacts to non-targets. Therefore, the potential impacts to non-targets, including T&E species would be variable under a technical assistance only alternative. It is possible that frustration caused by the inability to reduce damage and associated losses could lead to illegal killing of birds, which could lead to unknown effects on local non-target species populations, including some T&E species. When those people experiencing damage caused by wildlife reach a level where assistance does not adequately reduce damage or where no assistance is available, people have resorted to using chemical toxicants that are illegal for use on the intended target species (*e.g.*, see White et al. 1989, USFWS 2001,

FDA 2003). The use of illegal toxicants by those persons frustrated with the lack of assistance or assistance that inadequately reduces damage to an acceptable level can often result in the indiscriminate take of wildlife species.

Those persons requesting assistance would likely be those people to use lethal methods since a damage threshold has been met for that individual requestor that has triggered seeking assistance to reduce damage. The potential impacts on non-targets by those persons experiencing damage would be highly variable. People whose bird damage problems were not effectively alleviated by non-lethal control methods would likely resort to other means of legal or illegal lethal control. This could result in less experienced persons implementing control methods and could lead to greater take of non-target wildlife than the proposed action.

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

Alternative 3 – No Bird Damage Management Conducted by WS

Under this alternative, WS would not be directly involved with damage management activities in the State. Therefore, no direct impacts to non-targets or T&E species would occur by WS under this alternative. Birds could continue to be taken under depredation permits issued by the USFWS and the RIDEM, take could continue to occur during the regulated harvest season, non-native bird species could continue to be taken without the need for a permit, Muscovy ducks could be taken under the control order, and blackbirds could still be taken under the depredation order. Risks to non-targets and T&E species would continue to occur from those people who implement damage management activities on their own or through recommendations by the other federal, state, and private entities. Although some risks would occur from those people that implement bird damage management in the absence of any involvement by WS, those risks would likely be low, and would be similar to those under the other alternatives.

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

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

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

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

The cooperator requesting assistance would be made aware through a MOU, cooperative service agreement, or a similar document that those methods agreed upon could potentially be used on property owned or managed by the cooperator. Therefore, cooperator would be made aware of the use of those methods on property they own or manage prior to the initiation of any project, which would assist with identifying any risks to human safety associated with the use of those methods.

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

Although hazards to human safety from non-lethal methods exist, those methods would generally be regarded as safe when used by trained individuals who were experienced in their use. Although some risk of fire and bodily harm would exist from the use of pyrotechnics, lasers, and propane cannons, when used appropriately and in consideration of those risks, those methods can be used with a high degree of safety.

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

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

The use of lethal and live-capture traps has also been identified as a potential issue. Traps would typically be set in situations where human activity was minimal to ensure public safety. Traps rarely cause serious injury and would only be triggered through direct activation of the device.

Lethal traps available for birds are typically modified snap traps or snap traps placed in wooden birdhouse style boxes. These types of traps would typically be used to lethally remove woodpeckers causing damage to residential and non-residential buildings or other cavity nesting birds. Snap traps are traditional wooden mouse or rat traps. They are modified by adding ¼-inch hardware cloth to the trigger mechanism and the hammer or swing arm to increase the capture area. Both of these types of traps are hung on the exterior of the building receiving damage, and pose little risk of bodily harm to anyone but the individual placing the trap.

Live-capture traps available for birds are typically walk-in style traps, such as box/cage traps, nest traps, or decoy traps where birds enter but are unable to exit. Other types of live traps include Bal-Chatri traps that utilize small monofilament nooses to ensnare the talons of raptors, pole traps, padded leg hold traps, Dho-gaza traps, and mist nets. Human safety concerns associated with live traps used to capture birds require direct contact to cause bodily harm. If left undisturbed, risks to human safety would be minimal.

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

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

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

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

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

Risks to human safety from the use of avicides could occur 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 Rhode Island is DRC-1339 (3-chloro-p-toluidine hydrochloride) that could be used for bird damage management. DRC-1339 is currently registered with the EPA to manage damage associated with several bird species and can be formulated on a variety of bait types depending on the label. Technical DRC-1339 (powder) must be mixed with water and in some cases, a binding agent (required by the label for specific bait types). Once the technical DRC-1339, water, and binding agent, if required, are mixed, the liquid is poured over the bait and mixed until the liquid is absorbed and evenly distributed. The treated bait is then allowed to air dry. The mixing, drying, and storage of DRC-1339 treated bait occurs in controlled areas that are not accessible by the public. Therefore, risks to public safety from the preparation of DRC-1339 are minimal. Some risks do occur to the handlers during the mixing process from inhalation and direct exposure on the skin and eyes. Adherence to label requirements during the mixing and handling of DRC-1339 treated bait for use of personal protective equipment ensures the safety of WS' personnel handling and mixing treated bait. Therefore, risks to handlers and mixers that adhere to the personal protective equipment requirements of the label are low. Before application at bait locations, treated bait is mixed with untreated bait at ratios required by the product label to minimize non-target hazards and to avoid bait aversion by target species.

Locations where treated bait may be placed are determined based on product label requirements (*e.g.*, distance from water, specific location restrictions), the target bird species use of the site (determined through pre-baiting and an acclimation period), on non-target use of the area (areas with non-target activity would not be used or would be abandoned), and based on human safety (*e.g.*, in areas restricted or inaccessible by the public or where warning signs have been placed). Once appropriate locations were determined, treated baits would be placed in feeding stations or would be broadcast using mechanical methods (ground-based equipment or hand spreaders) and by manual broadcast (distributed by hand) per label requirements. Once baited using the diluted mixture (treated bait and untreated bait), when required by the label, locations would be monitored for non-target activity and to ensure the safety of the public. After each baiting session, all uneaten bait would be retrieved. Through pre-baiting, target birds can be acclimated to feed at certain locations at certain periods. By acclimating birds to a feeding schedule, baiting can occur at specific times to ensure bait placed is quickly consumed by target bird species, especially when large flocks of target species are present. The acclimation period would allow treated bait to be placed at a location only when target birds were conditioned to be present at the site, which provides a higher likelihood that treated bait would be consumed by the target species making it unavailable for potential exposure to humans. To be exposed to the bait, someone would have to

approach a bait site and handle treated bait. If the bait had been consumed by target species or if the bait was removed by WS, then treated bait would no longer be available and human exposure to the bait could not occur. Therefore, direct exposure to treated bait during the baiting process would only occur if someone approached a bait site that contained bait and if treated bait was present, would have to handle treated bait.

Factors that minimize any risk of public health problems from the use of DRC-1339 are: 1) its use is prohibited within 50 feet of standing water and cannot be applied directly to food or feed crops (contrary to some misconceptions, DRC-1339 is not applied to feed materials that livestock can feed upon), 2) DRC-1339 is highly unstable and degrades rapidly when exposed to sunlight, heat, or ultraviolet radiation. The half-life is about 25 hours; in general, DRC-1339 on treated bait material is almost completely broken down within a week if not consumed or retrieved, 3) the chemical is more than 90% metabolized in target birds within the first few hours after they consume the bait. Therefore, little material is left in bird carcasses that may be found or retrieved by people, 4) application rates are extremely low (EPA 1995), 5) a human would need to ingest the internal organs of birds found dead from DRC-1339 to be exposed, and 6) the EPA has concluded that, based on mutagenicity (*i.e.*, the tendency to cause gene mutations in cells) studies, this chemical is not a mutagen or a carcinogen (*i.e.*, cancer-causing agent) (EPA 1995).

Of additional concern is the potential exposure of people to crows harvested during the regulated hunting season that have ingested DRC-1339 treated bait. The hunting season for crows in the State during the development of this assessment occurred from June until the end of February the following calendar year with no daily take limit and no possession limit (RIDEM 2012*c*). Under the proposed action, baiting using DRC-1339 to reduce crow damage could occur in the State during the period of time when crows can be harvested. Although baiting could occur in rural areas of the State during those periods, most requests for assistance to manage crow damage during the period of time when crows can be harvested in the State occur in urban areas associated with urban crow roosts. Crows using urban communal roost locations often travel long distances to forage before returning to the roost location during the evening.

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

For a crow that ingested DRC-1339 treated bait to pose a potential risk to human safety to someone harvesting crows during the hunting season in the State, a hunter would have to harvest a crow that ingested DRC-1339 treated bait and subsequently consume certain portions of the crow. The mode of action of DRC-1339 requires ingestion by crows so handling a crow harvested or found dead would not pose any primary risks to human safety. Although not specifically known for crows, in other sensitive species, DRC-1339 is metabolized and/or excreted quickly once ingested. In starlings, nearly 90% of the DRC-1339 administered dosages well above the LD_{50} for starlings was metabolized or excreted within 30

minutes of dosage (Cunningham et al. 1979). In one study, more than 98% of a DRC-1339 dose delivered to starlings could be detected in the feces within 2.5 hours (Peoples and Apostolou 1967) with similar results found for other bird species (Eisemann et al. 2003). Once death occurs, DRC-1339 concentrations appear to be highest in the gastrointestinal tract of birds but some residue could be found in other tissue of carcasses (Giri et al. 1976, Cunningham et al. 1979, Johnston et al. 1999) with residues diminishing more slowly in the kidneys (Eisemann et al. 2003). However, most residue tests to detect DRC-1339 in tissues of birds have been completed using DRC-1339 dosages that far exceeded the known acute lethal oral dose for those species tested and far exceeds the level of DRC-1339 that would be ingested from treated bait. Johnston et al. (1999) found DRC-1339 residues in breast tissue of boat-tailed grackles (*Quiscalus major*) using acute doses ranging from 40 to 863 mg/kg. The acute lethal oral dose of DRC-1339 for boat-tailed grackles has been estimated to be $\leq$ 1 mg/kg, which is similar to the LD_{50} for crows (Eisemann et al. 2003). In those boat-tailed grackles consuming a trace of DRC-1339 up to 22 mg/kg, no DRC-1339 residues were found in the gastrointestinal track nor were residues found in breast tissue (Johnston et al. 1999).

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

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

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

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

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

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

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

Of additional concern with the use of immobilizing drugs and reproductive inhibitors would be the potential for human consumption of meat from waterfowl that have been immobilized using alpha chloralose or have consumed nicarbazin. Since waterfowl would be harvested during a regulated harvest season and consumed, the use of immobilizing drugs and potentially reproductive inhibitors is of concern. The intended use of immobilizing drugs is to live-capture waterfowl. Waterfowl would be conditioned to feed during a period in the day when consumption of treated bait ensures waterfowl do not disperse from the immediate area where the bait is applied. The use of immobilizing drugs and reproductive inhibitors targets waterfowl in urban environments where hunting and the harvest of waterfowl does not occur or was unlikely to occur (*e.g.*, due to city ordinances preventing the discharge of a firearm within city limits). However, it could be possible for target waterfowl to leave the immediate area where baiting is occurring after consuming bait and enter areas where hunting could occur. To mitigate this risk, withdrawal times are often established. A withdrawal time is the period established between when the animal consumed treated bait to when it is safe to consume the meat of the animal by humans.

Withdrawal periods are not well defined for free-ranging wildlife species for all drugs. In compliance with FDA use restrictions, the use of alpha chloralose would be prohibited for 30 days prior to and during the hunting season on waterfowl and other game birds that could be hunted. In the event that WS was requested to immobilize waterfowl or use nicarbazin during a period 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 immobilizing drugs or nicarbazin. In those cases, other methods would be employed.

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

No adverse effects to human safety have occurred from WS' use of methods to alleviate bird damage in the State from FY 2006 through FY 2012. The risks to human safety from the use of non-lethal and lethal methods, when used appropriately and by trained personnel, would be considered low.

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

Under this alternative, WS would be restricted to making recommendations of methods and the demonstration of methods only to alleviate damage. WS would only provide technical assistance to those people requesting assistance with bird damage and threats. The only methods that would not be available under this alternative would be mesurol, alpha chloralose, and DRC-1339. Although hazards to human safety from non-lethal methods exist, those methods are generally regarded as safe when used by trained individuals who are experienced in their use. Although some risk of fire and bodily harm exists from the use of pyrotechnics and propane cannons, when used appropriately and in consideration of those risks, they can be used with a high degree of safety.

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

The recommendation by WS that birds be harvested during the regulated hunting season, which is established by the RIDEM, would not increase risks to human safety above those risks already inherent

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

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

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

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

Alternative 3 – No Bird Damage Management Conducted by WS

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

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

Firearms, when handled appropriately and with consideration for safety, pose minimal risks to human safety.

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

Issue 4 - Effects on the Aesthetic Values of Birds

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

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

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

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

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

Activities would only be conducted on properties where a request for assistance was received and activities would only be conducted after an agreement for such services had been agreed upon by the property owner. Some aesthetic value would be gained by the removal of birds and the return of a more natural environment, including the return of native wildlife and plant species that may be suppressed or displaced by high bird densities.

Since those birds removed by WS under this alternative could be removed by other entities, WS' involvement in taking those birds would not likely be additive to the number of birds that could be taken

in the absence of WS' involvement. Birds could be removed by other entities with a depredation permit issued by the USFWS and the RIDEM, under depredation orders, under control orders, without the need for a permit (non-native species), or during the regulated hunting seasons.

WS' take of birds from FY 2006 through FY 2012 has been of low magnitude when compared to population estimates, trending data, and other available information. WS' activities would not likely be additive to the birds that would be taken in the absence of WS' involvement. Although birds removed by WS would no longer be present for viewing or enjoying, those birds would likely be taken by the property owner or manager if WS were not involved in the action. Given the limited take proposed by WS under this alternative, when compared to the known sources of mortality of birds and their population information, damage management activities conducted by WS pursuant to the proposed action would not adversely affect the aesthetic value of birds. The impact on the aesthetic value of birds and the ability of the public to view and enjoy birds under the proposed action would be similar to the other alternatives and would likely be low.

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

If those people seeking assistance from WS were those persons likely to conduct bird damage management activities in the absence of WS' involvement, then technical assistance provided by WS would not adversely affect the aesthetic value of birds in the State similar to Alternative 1. Birds could be lethally taken under this alternative by those entities experiencing bird damage or threats, which could result in localized reductions in the presence of birds at the location where damage was occurring. The presence of birds where damage was occurring would be reduced where damage management activities were conducted under any of the alternatives. Even the recommendation of non-lethal methods would likely result in the dispersal of birds from the area if those non-lethal methods recommended by WS were employed by those people receiving technical assistance. Therefore, technical assistance provided by WS would not prevent the aesthetic enjoyment of birds since any activities conducted to alleviate bird damage could occur in the absence of WS' participation in the action, either directly or indirectly.

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

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

Alternative 3 – No Bird Damage Management Conducted by WS

Under the no bird damage management by WS alternative, the actions of WS would have no impact on the aesthetic value of birds in the State. Those people experiencing damage or threats from birds would be responsible for researching, obtaining, and using all methods as permitted by federal, state, and local laws and regulations. The degree to which damage management activities would occur in the absence of assistance by any agency is unknown but likely lower compared to damage management activities that would occur where some level of assistance was provided. Birds could still be dispersed or removed under this alternative by those persons experiencing damage or threats of damage. The potential impacts on the aesthetic values of birds could be similar to the proposed action if similar levels of damage management activities are conducted by those persons experiencing damage or threats or is provided by other entities. If no action is taken or if activities were not permitted by the USFWS and the RIDEM, then no impact on the aesthetic value of birds would occur under this alternative.
Birds could continue to be dispersed and lethally taken by other entities under this alternative. Lethal take would continue to occur when permitted by the USFWS and the RIDEM through the issuance of depredation permits. Take 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 some species, take could occur any time without the need for a depredation permit.

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

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

Issue 5 - Humaneness and Animal Welfare Concerns of Methods

Humaneness and animal welfare concerns associated with methods available for use to manage bird damage have been identified as an issue. As described previously, most of those methods available for use to manage bird damage would be available under any of the alternatives, when permitted by the USFWS and the RIDEM. The humaneness and animal welfare concerns of methods available for use in Rhode Island, as the use of those methods relates to the alternatives, is discussed below.

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

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

As discussed previously, humaneness, in part, appears to be a person's perception of harm or pain inflicted on an animal. People may perceive the humaneness of an action differently. The challenge in coping with this issue is how to achieve the least amount of animal suffering.

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

Some methods have been stereotyped as "*humane*" or "*inhumane*". However, many "*humane*" methods can be inhumane if not used appropriately. For instance, a cage trap is generally considered by most members of the public as "*humane*". Yet, without proper care, live-captured wildlife in a cage trap can be treated inhumanely if not attended to appropriately.

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

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

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

Under the proposed action, lethal methods could also be employed to alleviate requests for assistance to alleviate or prevent bird damage and threats. Lethal methods would include shooting, DRC-1339, the recommendation that birds be harvested during the regulated hunting season, and euthanasia after birds were live-captured. WS' use of euthanasia methods under the proposed action would follow those required by WS' directives (see WS Directive 2.430, WS Directive 2. 505).

The euthanasia methods being considered for use under the proposed action for live-captured birds would be cervical dislocation and carbon dioxide. The AVMA guidelines on euthanasia list cervical dislocation

and carbon dioxide as acceptable methods of euthanasia for free-ranging birds, which can lead to a humane death (AVMA 2007). The use of cervical dislocation or carbon dioxide for euthanasia would occur after the animal has been live-captured and away from public view. Although the AVMA guidelines also list gunshot as a conditionally acceptable method of euthanasia for free-ranging wildlife, there is greater potential the method may not consistently produce a humane death (AVMA 2007). WS' personnel that employ firearms to address bird damage or threats to human safety would be trained in the proper placement of shots to ensure a timely and quick death.

Although the mode of action of DRC-1339 is not well understood, it appears to cause death primarily by nephrotoxicity in susceptible species and by central nervous system depression in non-susceptible species (DeCino et al. 1966, Westberg 1969, Schafer, Jr. 1984). DRC-1339 causes irreversible necrosis of the kidney and the affected bird is subsequently unable to excrete uric acid with death occurring from uremic poisoning and congestion of major organs (DeCino et al. 1966, Knittle et al. 1990). The external appearances and behavior of starlings that ingested DRC-1339 slightly above the LD_{50} for starlings appeared normal for 20 to 30 hours, but water consumption doubled after 4 to 8 hours and decreased thereafter. Food consumption remained fairly constant until about 4 hours before death, at which time starlings refused food and water and became listless and inactive. The birds perched with feathers fluffed as in cold weather and appeared to doze, but were responsive to external stimuli. As death nears, breathing increased slightly in rate and became more difficult; the birds no longer responded to external stimuli and became comatose. Death followed shortly thereafter without convulsions or spasms (DeCino et al. 1966). Birds ingesting a lethal dose of DRC-1339 become listless and lethargic, and a quiet death normally occurs in 24 to 72 hours following ingestion. This method appears to result in a less stressful death than which probably occurs by most natural causes, which are primarily disease, starvation, and predation. In non-sensitive birds and mammals, central nervous system depression and the attendant cardiac or pulmonary arrest is the cause of death (Felsenstein et al. 1974). DRC-1339 is the only lethal method that would not be available to other entities under the other alternatives. DRC-1339 to manage damage caused by certain species of birds would only be available to WS' personnel for use. A similar product containing the same active ingredient could commercially be available as a restricted use pesticide for use to manage damage associated with blackbirds and starlings; however, the product is not currently registered for use in Rhode Island.

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

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

Alpha chloralose could be used by WS as a sedative to live-capture geese and other waterfowl. Although overdosing waterfowl with alpha chloralose can cause death, WS would employ alpha chloralose as a

non-lethal method only. When using alpha chloralose, WS' personnel would be present on site to retrieve birds that become sedated. Some concern occurs that waterfowl may drown if sedation occurs while they are loafing on water. WS would ensure that a boat and/or a canoe were available for quick retrieval of birds that become sedated while in the water.

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

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

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

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

Those people requesting assistance would be directly responsible for the use and placement of methods and if monitoring or checking of those methods does not occur in a timely manner, captured wildlife could experience suffering and if not addressed timely, could experience distress. The amount of time an animal is restrained under the proposed action would be shorter compared to a technical assistance alternative if those requesters implementing methods are not as diligent or timely in checking methods. Similar to Alternative 3, it can be difficult to evaluate the behavior of individual people and determining what may occur under given circumstances. Therefore, only the availability of WS' assistance can be evaluated under this alternative since determining human behavior can be difficult. If those persons seeking assistance from WS apply methods recommended by WS through technical assistance as intended and as described by WS, then those methods would be applied as humanely as possible to minimize pain and distress. If those persons provided technical assistance by WS apply methods not recommended by

WS or do not employ methods as intended or without regard for humaneness, then the issue of method humaneness would be of greater concern since pain and distress of birds would likely be higher.

Alternative 3 – No Bird Damage Management Conducted by WS

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

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

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

The populations of several migratory bird species are sufficient to allow for annual harvest seasons that typically occur during the fall migration periods of those species. Migratory bird hunting seasons are established under frameworks developed by the USFWS and implemented in the State by the RIDEM. Those species addressed in this EA that have established hunting seasons include snow geese, brant, wood ducks, gadwalls, American wigeons, American black ducks, mallards, blue-winged teal, Northern shovelers, Northern pintails, green-winged teal, canvasbacks, redheads, ring-necked ducks, greater scaup, lesser scaup, common eiders, surf scoters, white-winged scoters, black scoters, long-tailed ducks, buffleheads, common goldeneyes, hooded mergansers, common mergansers, red-breasted merganser, ruddy ducks, Northern bobwhites, ring-necked pheasants, ruffed grouse, wild turkeys, American coots, American woodcocks, Wilson's snipes, mourning doves, American crows, and fish crows. For many migratory bird species considered harvestable during a hunting season, the number of birds harvested during the season is reported by the USFWS and/or the RIDEM in published reports.

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

The magnitude of take addressed in the proposed action would be low when compared to population data and the mortality of birds from all known sources. When WS' proposed take of those bird species considered harvestable was included as part of the known mortality of those species and compared to the estimated populations of those species, the impact on those species' population was below the level of removal required to lower population levels. The USFWS and the RIDEM would determine the number of birds taken annually by WS through the issuance of depredation permits and by regulating take through the depredation orders and control orders.

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

With oversight of bird populations by the USFWS and the RIDEM, the number of birds that could be lethally removed by WS would not limit the ability of those people interested to harvest those bird species during the regulated season. All take by WS would be reported to the USFWS and the RIDEM annually to ensure take by WS was incorporated into population management objectives established for bird populations. Based on the limited take proposed by WS and the oversight by the USFWS and the RIDEM, WS' take of birds annually under this alternative would have no effect on the ability of those people interested to harvest birds during the regulated harvest season.

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

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

Alternative 3 – No Bird Damage Management Conducted by WS

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

Issue 7 - Effectiveness of Bird Damage Management Methods

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

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

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

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

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

As part of an integrated approach to managing bird damage, WS would have the ability to adapt methods to damage situations to effectively reduce or prevent damage from occurring. Under the proposed integrated approach, all methods, individually or in combination, could be employed as deemed appropriate through WS' Decision Model to address requests for assistance. WS' objective when

receiving a request for assistance under the proposed action is to reduce damage and threats to human safety or to prevent damage from occurring using an integrated approach to managing bird damage. Therefore, under the proposed action, WS would employ methods adaptively to achieve that objective.

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

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

The use of only non-lethal methods to alleviate damage involving other bird species has had similar results requiring constant application and re-application. Recent research has indicated that non-lethal harassment programs can reduce bird numbers at specific sites, but those programs do little to reduce the overall population of nuisance birds locally and may shift the problem elsewhere. Preusser et al. (2008) found that 12 of 59 geese banded at a study site in Orange County, New York that were hazed regularly were observed at an unmanaged location 1.2 km away on 161 occasions during 2004. This is similar to findings by Holevinski et al. (2007) who documented hazed radio-marked geese moved an average of 1.18 km at an urban site in Brighton, New York. Although Canada geese are not specifically addressed in this EA, the discussion of those examples of management methods employed to address goose damage are likely representative of the results achieved by those methods when applied to any bird species that exhibit similar behaviors such as those species addressed in this assessment. Cooper and Keefe (1997) found that fencing and harassment with dogs were the only effective short-term approaches to reducing goose damage but likely redistribute the problem elsewhere.

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

resulted in reduced hazards to a nearby airport. Cooper (1991) reported the removal of geese posing or likely to pose a hazard to air safety at airports considerably reduced the population of local geese, decreased the number of goose flights through airport operations airspace, and reduced goose-aircraft collisions at Minneapolis-St. Paul International Airport. An integrated approach to resolving goose damage is likely the most effective (Smith et al. 1999). In addition, Dolbeer et al. (1993*a*) demonstrated that an integrated approach (including removal of offending birds) reduced bird hazards at airports and substantially reduced bird collisions with aircraft by as much as 89%. Jensen (1996) also reported that an integrated approach that incorporated the removal of geese, reduced goose-aircraft collisions by 80% during a two year period. Translocating geese to areas where they can be hunted has been found to be an effective method to reduce conflicts with geese at problem sites. Hall and Groniger (2002) found that translocated geese were subject to higher hunting mortality by about 8% than non-relocated geese and that hunting as a management tool reduced the population of geese at Truckee Meadows in Nevada from about 2,000 to 400 geese. Holevinski et al. (2006) found that more translocated adult geese (23.8%) and juvenile geese (22.0%) in New York were harvested than control geese when translocated to an area open to hunting; and that only seven of 177 translocated geese returned to the original capture site. Recent research at an airport in the United Kingdom found that through the capture of approximately 287 geese each year over a period of three years, combined with the oiling of 2,980 eggs and hazing geese from problem roost sites, reduced goose movements over the airfield by 63% (Baxter and Robinson 2007).

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

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

Another concern when employing methods to alleviate bird damage associated with bird roosts is the apparent success of methods being claimed when birds actually have dispersed from an area naturally. This could apply to both lethal and non-lethal methods. Bird migration periods vary during the spring and fall depending on the geographical region and other natural stimuli (Verbeek and Caffrey 2002). For

example, many of the studies evaluating methodologies for alleviating crow damage occurred during periods of time when crows could have been dispersing naturally which must be considered when evaluating the success of methods in reducing damage. Boyd and Hall (1987) determined a reduction of the number of crows in roost by 25% using DRC-1339 could reduce damage occurring from crows using local roosts in Arkansas and Kentucky. However, work conducted using DRC-1339 occurring in January and February when roosts could have been breaking up naturally as crows disperse to breeding areas. Chipman et al. (2008) found the use of non-lethal methods could be effective in dispersing urban crow roosts in New York. However, hazing projects did not occur until after pre-treatment assessments of crow roosts were conducted from November through January during the six-year project (Chipman et al. 2008). Thus, similar to the work conducted by Boyd and Hall (1987), those non-lethal methods employed by Chipman et al. (2008) in New York occurred in January and could have occurred during the period of time when crows begin to disperse naturally. Avery et al. (2008) noted that the use of effigies and other non-lethal methods at crow roosts in Pennsylvania during December 2005 were successful in breaking up the large roost into smaller roosts but the roosts did not begin to disperse until January. Therefore, to evaluate effectively the future use of methods, in bird damage management activities, WS would consider the time of year those methods were employed in relationship to when birds may have dispersed naturally.

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

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

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

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

Under this alternative, most of the methods described in Appendix B would be recommended and/or demonstrated, except for alpha chloralose, mesurol, and DRC-1339. WS would recommend methods using the WS Decision Model based on information provided by those people requesting assistance or through site visits. WS would describe and demonstrate the correct application of those lethal and non-lethal methods available. If those persons receiving technical assistance apply methods as recommended and demonstrated by WS, those methods when employed to alleviate bird damage are reasonably anticipated to be effective in resolving damage occurring. Under this alternative, those people requesting assistance would be provided information on bird behavior to ensure methods were applied when the use of those methods would likely be most effective.

The effectiveness of methods under this alternative would be similar to the other alternatives since many of the same methods would be available, except alpha chloralose, mesurol, and DRC-1339. If methods were employed as intended and with regard to the behavior of the bird species causing damage, those methods are likely to be effective in resolving damage. The demonstration of methods and the information provided on bird behavior provided by WS through technical assistance under this alternative would likely increase the effectiveness of the methods employed by those people requesting assistance. However, if methods are employed that are not recommended or if those methods are employed incorrectly by those people requesting assistance, methods could be less effective in resolving damage or threats.

Alternative 3 – No Bird Damage Management Conducted by WS

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

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

4.2 CUMULATIVE IMPACTS OF THE PROPOSED ACTION BY ISSUE

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

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

WS does not normally conduct direct damage management activities concurrently with such agencies or other entities in the same area, but may conduct damage management activities at adjacent sites within the same period. In addition, commercial pest control companies may conduct damage management activities in the same area. The potential cumulative impacts analyzed below could occur because of WS' damage management program activities over time or because of the aggregate effects of those activities combined with the activities of other agencies and private entities. Through ongoing coordination and collaboration between WS, the USFWS, and the RIDEM, activities of each agency and the take of birds would be available. Damage management activities in the State would be monitored to evaluate and analyze activities to ensure they are within the scope of analysis of this EA.

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

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

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

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

With management authority over bird populations, the USFWS and the RIDEM can adjust take levels, including the take of WS, to ensure population objectives for bird species were achieved. Consultation

and reporting of take by WS would ensure the USFWS and the RIDEM considers any activities conducted by WS.

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

Historical outcomes of WS' damage management activities on wildlife

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

SOPs built into the WS program

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

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

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

constant level that would prevent non-targets from accessing critical resources that would threaten survival of a population.

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

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

Chemical methods available for use under the proposed action would be taste repellents, nicarbazin, mesurol, alpha chloralose, and DRC-1339, which are described in Appendix B. Except for repellents that would be applied directly to the affected resource, all chemical methods would be employed using baits that would be highly attractive to target species and would be used in areas where exposure to non-targets would be minimal. The use of those methods requires an acclimation period and monitoring of potential bait sites for non-target activity. All chemicals would be used according to product label, which ensure that proper use would minimize non-target threats. WS' adherence to directives and SOPs governing the use of chemicals also ensures non-target hazards would be minimal.

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

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

Only those repellents registered for use in the State by the EPA and the RIDEM would be used or recommended by WS as part of an integrated approach to managing damage and threats associated with birds. The recommendation and/or use of repellents would also follow all label instructions approved by the EPA. Repellents would be registered in accordance with the FIFRA through a review process administered by the EPA. The FIFRA requires the registration, classification, and regulation of all pesticides used in the United States. Repellents available for use to disperse birds from areas of application must be registered with the EPA according to the FIFRA. Although some hazards exist from

the use of repellents, hazards occur primarily to the handler and applicator. When repellents that were registered for use by the EPA in accordance to the FIFRA and were applied according to label requirements, no adverse effects to non-targets would be expected.

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

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

The methods described in Appendix B have a high level of selectivity and can be employed using SOPs to ensure minimal effects to non-targets species. Non-targets were not taken by WS in Rhode Island during activities to alleviate bird damage from FY 2006 through FY 2012. Based on the methods available to alleviate bird damage and/or threats, WS does not anticipate the number of non-targets taken to reach a magnitude where declines in those species' populations would occur. Therefore, take of non-targets under the proposed action would not cumulatively affect non-target species. WS' has reviewed the T&E species listed by the RIDEM, the USFWS, and the National Marine Fisheries Services and would take the appropriate action regarding compliance with the ESA and State laws and regulations. Cumulative impacts would be minimal on non-targets from any of the alternatives discussed**.**

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

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

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

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

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

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

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

DRC-1339 exhibits a low persistence in soil or water, and bioaccumulation of the chemical is unlikely (EPA 1995). Additionally, the relatively small quantity of DRC-1339 that could potentially be used in bird damage management programs in Rhode Island, the chemical's instability, which results in degradation of the product, and application protocols used in WS' programs further reduces the likelihood of any environmental accumulation. There are no formulations of DRC-1339 currently registered for use in Rhode Island and DRC-1339 has not been used by WS to manage bird damage in Rhode Island. If DRC-1339 were registered in Rhode Island, the use of DRC-1339 under the proposed action and in other damage management activities would not be expected to increase to a level that effects would occur from

the cumulative use of the chemical. Based on potential use patterns, the chemical and physical characteristics of DRC-1339, and factors related to the environmental fate, no cumulative impacts are expected from the lethal chemical components used or recommended by the WS program in Rhode Island.

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

WS' personnel are required to attend training courses on the proper use of alpha chloralose and employees using alpha chloralose must be certified in the application of alpha chloralose. Training would ensure proper care and handling occurred, ensure that proper doses were administered, and ensure human safety.

Direct application of chemical methods to target species would ensure that there are no cumulative impacts to human safety. All chemical methods would be tracked and recorded to ensure proper accounting of used and unused chemicals occurs. All chemicals would be stored and transported according to FDA and DEA regulations, including the directives of the cooperating agencies. The amount of chemicals used or stored by WS and cooperating agencies would be minimal to ensure human safety. Based on this information, the use of chemical methods as part of the proposed action by WS and cooperating agencies would not have cumulative impacts on human safety.

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

WS has received no reports or documented any adverse effects to human safety from WS' bird damage management activities conducted from FY 2006 through FY 2012. No cumulative effects from the use of those methods discussed in Appendix B would be expected given the use patterns of those methods for

resolving bird damage in the State. For these reasons, WS concludes that the use of methods would not create an environmental health or safety risk to children from implementing the proposed action. It is not anticipated that the proposed action or the other alternatives would result in any adverse or disproportionate environmental impacts to minorities and persons or populations of low-income people.

Issue 4 - Effects on the Aesthetic Values of Birds

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

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

Bird population objectives are established and enforced by the USFWS and the RIDEM through the regulating of take during the statewide hunting season after consideration of other known mortality factors. Therefore, WS has no direct impact on the status of the bird population since all take by WS occurs at the discretion of the USFWS and the RIDEM. Since those people seeking assistance could remove birds from areas where damage was occurring with or without a permit from the USFWS or the RIDEM, WS' involvement would have no effect of the aesthetic value of birds in the area where damage was occurring. When damage caused by birds has occurred, any removal of birds by the property or resource owner would likely occur whether WS was involved with taking the birds or not.

Therefore, the activities of WS are not expected to have any cumulative adverse effects on this element of the human environment if occurring at the request of a property owner and/or manager.

Issue 5 - Humaneness and Animal Welfare Concerns of Methods

WS continues to seek new methods and ways to improve current technology to improve the humaneness of methods used to manage damage caused by wildlife. Cooperation with individuals and organizations involved in animal welfare continues to be an agency priority for the purpose of evaluating strategies and defining research aimed at developing humane methods.

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

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

evaluated to ensure SOPs were adequate to ensure those methods continue to be used to minimize suffering and that wildlife captured are addressed in a timely manner to minimize distress.

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

As discussed in this EA, the magnitude of WS' bird take for damage management purposes from FY 2006 through FY 2012 was low when compared to the total take of birds and when compared to the estimated statewide populations of those species. Since all take of birds is regulated by the USFWS and the RIDEM, the take of birds by WS that would occur annually and cumulatively would occur pursuant to bird population objectives established in the State. WS' take of birds (combined take) annually to alleviate damage would be a minor component of the known annual take that occurs during the harvest seasons.

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

Issue 7 - Effectiveness of Bird Damage Management Methods

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

Effectiveness is based on the types of methods employed, the application of the method, restrictions on the use of the method(s), the skill of the personnel using the method and, for WS' personnel, the guidance provided by WS' Directives and policies. The goal of the WS' program is to reduce damage, risks, and conflicts with wildlife as requested. WS recognizes that localized population reduction could be short-term and that new individuals may immigrate, be released at the site, or be born to animals remaining at the site (Courchamp et al. 2003). The ability of an animal population to sustain a certain level of removal and to eventually return to pre-management levels; however, does not mean individual management actions were unsuccessful, but that periodic management may be necessary.

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

As part of an integrated approach to managing bird damage, WS has the ability to adapt methods to damage situations to effectively reduce or prevent damage from occurring. Under the proposed integrated

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

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

CEQ does not require a formal, monetized cost-benefit analysis to comply with the NEPA (40 CFR 1508.14) and consideration of this issue is not essential to making a reasoned choice among the alternatives being considered. However, the methods determined to be most effective to reduce damage and threats to human safety caused by birds and that prove to be the most cost effective will receive the greatest application. As part of an integrated approach, evaluation of methods will continually occur to allow for those methods that are most effective at resolving damage or threats to be employed under similar circumstance where birds are causing damage or pose a threat. Additionally, management operations may be constrained by cooperator funding and/or objectives and needs. The cost effectiveness of methods and the effectiveness of methods are linked. The issue of cost effectiveness as it relates to the effectiveness of methods is discussed in the following issue.

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

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

managing bird damage that is agreed upon by the cooperator. WS' legislative authority to manage animal damage was also addressed in Chapter 1 of this EA.

CHAPTER 5 - LIST OF PREPARERS AND PERSONS CONSULTED

5.1 LIST OF PREPARERS AND REVIEWERS

Timothy S. Cozine CWB®, Staff Wildlife Biologist	USDA-APHIS-Wildlife Services
Ryan Wimberly, Environmental Management Coordinator	USDA-APHIS-Wildlife Services
Donald J. Wilda CWB®, District Supervisor	USDA-APHIS-Wildlife Services
Monte D. Chandler, State Director	USDA-APHIS-Wildlife Services

5.2 LIST OF PERSONS CONSULTED

Jason Osenkowski, Wildlife Biologist	RIDEM DFW
Brian Tefft, Wildlife Biologist	RIDEM DFW
Chris Dwyer, Senior Gamebird Biologist	USFWS, Migratory Birds
Anthony Tur, USFWS Biologist	USFWS, NEFO, Ecological Services

APPENDIX A
LITERATURE CITED

Aderman, A.R., and E.P. Hill. 1995. Locations and numbers of double-crested cormorants using winter roosts in the Delta region of Mississippi. Colonial Waterbirds 18 (Spec. Pub. 1):143-151.

Aguilera, E., R.L. Knight, and J.L. Cummings. 1991. An evaluation of two hazing methods for urban Canada geese. Wildlife Society Bulletin 19:32-35.

Alderisio, K.A., and N. Deluca. 1999. Seasonal enumeration of fecal coliform bacteria from the feces of ring-billed gulls (*Larus delawarensis*) and Canada geese (*Branta canadensis*). Applied and Environmental Microbiology 65:5628–5630.

Allan, J.R., J.S. Kirby, and C.J. Feare. 1995. The biology of Canada geese *Branta canadensis* in relation to the management of feral populations. Wildl. Bio. 1:129-143.

AVMA. 1987. Panel report on the colloquium on recognition and alleviation of animal pain and distress. Journal of the American Veterinary Medical Association. 191:1186-1189.

AVMA. 2007. AVMA guidelines on euthanasia. American Veterinary Medical Association. http://www.avma.org/issues/animal_welfare/euthanasia.pdf. Accessed on February 2, 2009.

Apostolou, A. 1969. Comparative toxicity of the avicides 3-chloro-*p*-toluidine and 2-chloro-4-acetotoluidide in birds and mammals. Ph.D. Dissertation, Univ. of California-Davis. 178 pp.

Arhart, D.K. 1972. Some factors that influence the response of European Starlings to aversive visual stimuli. M.S. Thesis, Oregon State University, Corvallis, Oregon.

Atlantic Flyway Council. 2003. Atlantic Flyway Mute Swan Management Plan 2003 to 2013. Prepared by the Snow Goose, Brant, and Swan Committee Atlantic Flyway Technical Section. Accessed online 30 April 2012. http://www.michigan.gov/documents/dnr/AFC_mute_swan_plan1_364878_7.pdf.

Atlantic Flyway Council. 2009. 2008 Mid-summer Mute Swan Survey Results. Snow Goose, Brant, ands Swan Committee Atlantic Flyway Technical Section. Accessed online 30 April 2012. http://www.docstoc.com/docs/50462172/2008-Mid-Summer-Mute-Swan-Survey-Results-Atlantic-Flyway-Council.

Atlantic Flyway Council. 2011. Atlantic Brant Management Plan 2002, Revised 2011. Prepared by the Snow Goose, Brant, and Swan Committee Atlantic Flyway Technical Section.

Avery, M.L., J.W. Nelson, and M.A. Cone. 1992. Survey of bird damage to blueberries in North America. Proceedings of the Eastern Wildlife Damage Control Conference 5:105-110.

Avery, M.L., and D.G. Decker. 1994. Responses of captive fish crows to eggs treated with chemical repellents. Journal of Wildlife Management 58:261-266.

Avery, M.L., J.S. Humphrey, and D.G. Decker. 1997. Feeding deterrence of anthraquinone, anthracene, and anthrone to rice-eating birds. Journal of Wildlife Management 61:1359-1365.

Avery, M.L. 2002. Avian repellents. Pp. 122-128 *in* J. R. Plimmer, ed. Encyclopedia of agrochemicals. Volume 1. John Wiley & Sons, Hoboken, New Jersey. http://www.aphis.usda.gov/ws/nwrc/is/02pubs/aver027.pdf

Avery, M.L., J.S. Humphrey, E.A. Tillman, K.O. Phares, and J.E. Hatcher. 2002*a*. Dispersing vulture roosts on communication towers. Journal of Raptor Research 36:45–50.

Avery, M.L., E.C. Greiner, J.R. Lindsay, J.R. Newman, and S. Pruett-Jones. 2002*b*. Monk parakeet management at electric utility facilities in south Florida. Proceedings of the Vertebrate Pest Conference 20:140–145.

Avery, M.L., J.R. Lindsay, J.R. Newman, S. Pruett-Jones, and E.A. Tillman. 2006*a*. Reducing monk parakeet impacts to electric utility facilities in South Florida. Pp. 125-136 *in* e. C. J. Feare and D. P.Cowan, eds. Advances in vertebrate pest management, Vol IV. Filander Verlag, Furth, Federal Republic of Germany.

Avery, M.L., K.L. Keacher, and E.A. Tillman. 2006*b*. Development of nicarbazin bait for managing rock pigeon populations. Pp. 116-120 *in* R.M. Timm and J. M. O'Brien eds. Proceedings of the 22nd Vertebrate Pest Conference. University of California-Davis, Davis California 95616.

Avery, M.L., E.A. Tillman, and J.S. Humphrey. 2008*a*. Effigies for dispersing urban crow roosts. Pp. 84-87 *in* R.M. Timm and M.B. Madon, eds. Proc. 23rd Vertebr. Pest Conf., University of California-Davis.

Avery, M.L., K.L. Keacher, and E.A. Tillman. 2008*b*. Nicarbazin bait reduces reproduction by pigeons (*Columba livia*). Wildlife Research 35:80-85.

Bateson, P. 1991. Assessment of pain in animals. Animal Behaviour, 42: 827-839.

Baxter, A.T., and A.P. Robinson. 2007. Monitoring and influencing feral Canada Goose behavior to reduce birdstrike risks to aircraft. International Journal of Pest Management. 53:341-346.

Beason, R. C. 1995. Horned lark (*Eremophila alpestris*) in A. Poole and F. Gill, editors. The Birds of North America Online. Cornell Lab of Ornithology, Ithaca, New York, USA. http://bna.birds.cornell.edu/bna/species/195.

Beaver, B.V., W. Reed, S. Leary, B. McKiernan, F. Bain, R. Schultz, B.T. Bennett, P. Pascoe, E. Shull, L. C. Cork, R. Franis-Floyd, K.D. Amass, R. Johnson, R. H. Schmidt, W. Underwood, G.W. Thorton, and B. Kohn. 2001. 2000 Report of the AVMA Panel on Euthanasia. J. Am. Vet Med Assoc 218:669-696.

Bédard, J., A. Nadeau, and M. Lepage. 1995. Double-crested cormorant culling in the St. Lawrence River Estuary. Colonial Waterbirds 18 (Spec. Pub. 1): 78-85.

Bédard, J., A. Nadeau, and M. Lepage. 1999. Double-crested cormorant culling in the St. Lawerence River Estuary: Results of a 5 year program. Pp. 147-154 *in* M.E. Tobin, ed. Symposium on Double-crested Cormorants: Population Status and Management Issues in the Midwest. USDA Tech. Bull. No. 1879.

Beeton A.M., and L. Wells. 1957. A Bronzed Grackle (*Quiscalus quiscula*) feeding on live minnows. Auk 74:263–264.

Belant, J.L. 1993. Nest-site selection and reproductive biology of roof- and island-nesting herring gulls. Transactions of the North American Wildlife Natural Resources Conference 58:78–86.

Belant, J.L., T.W. Seamans, L.A. Tyson, and S.K. Ickes. 1996. Repellency of methyl anthranilate to pre-exposed and naive Canada geese. Journal of Wildlife Management 60:923-928.

Besser, J. F. 1964. Baiting starlings with DRC-1339 at a large cattle feedlot, Ogden, Utah, January 21 - February 1, 1964. U. S. Fish and Wildl. Serv., Denver Wildl. Res. Ctr., Denver, CO. Suppl. Tech. Rep. Work Unit F9.2.

Besser, J.F. 1985. A grower's guide to reducing bird damage to U.S. agricultural crops. Bird Damage Research Rep. No. 340. U. S. Fish and Wildl. Serv. Denver Wildl. Res. Center. 84 pp.

Besser, J.F., W.C. Royal, and J.W. DeGrazio. 1967. Baiting European starlings with DRC-1339 at a cattle feedlot. Journal of Wildlife Management 3:48-51.

Besser, J.F., J.W. DeGrazio, and J.L. Guarino. 1968. Costs of wintering European starlings and red-winged blackbirds at feedlots. Journal of Wildlife Management 32:179-180.

Birding in Rhode Island. 2011. Rhode Island Checklist. http://ribird.org/RI_checklist/index.html. Website accessed 2 May 2012.

BirdLife International. 2012. IUCN Red List of Threatened Species. Version 2012.2. www.iucnredlist.org. Website accessed 23 January 2013..

Bishop, R.C. 1987. Economic values defined. Pp. 24 -33 *in* D. J. Decker and G. R. Goff, eds. Valuing wildlife: economic and social perspectives. Westview Press, Boulder, Colorado. 424 pp.

Blackwell, B.F., R.A. Dolbeer, and L.A. Tyson. 2000. Lethal control of piscivorous birds at aquaculture facilities in the northeast United States: effects on populations. North American Journal of Aquaculture 62:300-307.

Blackwell, B.F., G.E. Bernhardt, and R.A. Dolbeer. 2002. Lasers as non-lethal avian repellents. Journal of Wildlife Management 66:250-258.

Blandespoor, H.D., and R.L. Reimink. 1991. The control of swimmer's itch in Michigan: past, present and future. Michigan Academ. XXIV, p. 7-23.

Blokpoel, H., and W.C. Scharf. 1991. The ring-billed gull in the Great Lakes of North America. Proceedings of the International Ornithological Congress 20:2372–2377.

Bomford, M. 1990. Ineffectiveness of a sonic device for deterring European Starlings. Wild. Soc. Bull. 18:151-156.

Booth, T.W. 1994. Bird Dispersal Techniques. Pp. E-19 - E-24 *in* S.E. Hygnstrom, R.M. Timm, and G.E. Larson, eds. Prevention and Control of Wildlife Damage. University of Nebraska Cooperative Extension Service, Lincoln, Nebraska.

Boyd, F.L., and D.I. Hall. 1987. Use of DRC-1339 to control crows in three roosts in Kentucky and Arkansas. Third Eastern Wildlife Damage Control Conference 3:3-7.

Brauning, D.W., ed. 1992. Atlas of breeding birds in Pennsylvania. Univ. Pittsburgh Press, Pittsburgh, Pa. 484 pp.

Brown, C.R., and M.B. Brown. 1995. Cliff Swallow (*Petrochelidon pyrrhonota*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/149.

Brown, C.R., and M.B. Brown. 1999. Barn Swallow (*Hirundo rustica*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/452.

Bruce, R.D. 1985. An Up-and-Down procedure for acute toxicity testing. Fundamentals of Applied Toxicology 5:151-157.

Bruce, R.D. 1987. A confirmatory study of the up-and-down method for acute oral toxicity testing. Fundamentals of Applied Toxicology 8:97-100.

Buckley, Neil J. 1999. Black Vulture (*Coragyps atratus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/411.

Buehler, D.A. 2000. Bald Eagle (*Haliaeetus leucocephalus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/506.

Buhler, R. D., J.D. Lambley, and T. Sim IV. 2001. Pest Risk Analysis for the Monk Parakeet in Kansas. Kansas Dept. Agriculture, Plant Protection Program.

Bull, J. 1973. Exotic birds in the New York City area. Wilson Bulletin 85:501-505.

Bull, J., and J. Farrand, Jr. 1977. The Audubon Society Field Guide to North American Birds, Eastern Region. Alfred A. Knopf, Inc., New York, New York.

Bunn, A.G., W. Klein, and K.L. Bildstein. 1995. Time-of-day effects on the numbers and behavior of non-breeding raptors seen on roadside surveys in eastern Pennsylvania. J. Field Ornithol. 66:544–552.

Burgio, K. 2012. University of Connecticut Monk Parakeet Research. Website accessed 9 March 2012. http://www.eeb.uconn.edu/people/burgio/index.htm#start.

Butler, R.W. 1992. A review of the biology and conservation of the great blue heron (*Ardea herodias*) in British Columbia. Can. Wildl. Serv. Tech. Rep. No. 154, Delta, British Columbia.

Butterfield J., J.C. Coulson, S.V. Kearsey, P. Monaghan, J.H. McCoy, and G.E. Spain. 1983. The herring gull, *Larus argentatus*, as a carrier of *Salmonella*. Journal of Hygiene, Camb. 91:429-436.

Carlson, J.C., A.B. Franklin, D.R. Hyatt, S.E. Pettit, and G.M. Linz. 2010. The role of starlings in the spread of Salmonella within concentrated animal feeding operations. Applied Ecology 48:479–486.

California Department of Fish and Game. 1991. Final environmental document - bear hunting. Title 14 Calif. Code of Regs. Calif. Dept. of Fish and Game, State of California, April 25, 1991. 337 pp.

California Department of Pesticide Regulation. 2007. California Department of Pesticide Regulation Public Report 2007-8. http://www.cdpr.ca.gov/docs/registration/ais/publicreports/5944.pdf. Accessed November 20, 2008.

Caudell J., and S. Shwiff. 2006. Cost effectiveness of OvoControl G for managing nuisance Canada goose (*Branta canadensis*) populations. Twelfth Wildlife Damage Management Conference April 9-12, 2007.

Chipman, R.B., T.L. Devault, D. Slate, K.J. Preusser, M.S. Carrara, J.W. Friers, and T.P. Alego. 2008. Non-lethal methods to reduce to reduce conflicts with winter urban crow roosts in New York: 2002-2007. Pp. 88-93 *in* R.M. Timm and M.B. Madon, eds. Proc. 23rd Vertebr. Pest Conf., University of California-Davis.

Ciaranca, M.A., C.C. Allin, and G.S. Jones. 1997. Mute Swan (*Cygnus olor*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/273.

Cink, C.L., and C.T. Collins. 2002. Chimney Swift (*Chaetura pelagica*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/646.

Clark, L. and R. G. McLean. 2003. A review of pathogens of agricultural and human health interest found in blackbirds. Pages 103-108 *In* G. M. Linz, ed., Management of North American blackbirds. Proceedings of a special symposium of the Wildlife Society 9th Annual Conference. Bismarck, North Dakota, September 27, 2002.

Clark, L., and J. Hall. 2006. Avian influenza in wild birds: status as reservoirs, and risk to humans and agriculture. Ornithological Monographs 60:3-29.

Coleman, J. S. and J. D. Fraser. 1989. Habitat use and home ranges of black and turkey vultures. Journal of Wildlife Management 53:782–792.

Collar, N.J. 1997. Monk Parakeet. Handbook of Birds of the World (Vol.4: Sandgrouse to Cuckoos): 445, Plates 50. Lynx Edicions, Barcelona.

Connecticut Department of Energy and Environmental Protection. 1999. Wildlife in Connecticut, Informational Series, Mute Swan *Cygnus olor*. Accessed online 30 April 2012. http://www.ct.gov/dep/lib/dep/wildlife/pdf_files/outreach/fact_sheets/mtswan.pdf.

Conover, M.R. 1982. Evaluation of behavioral techniques to reduce wildlife damage. Proc. Wildl.-Livestock Relation. Sym. 10:332-344.

Conover, M.R. 1984. Comparative effectiveness of avitrol, exploders, and hawk-kites in reducing blackbird damage to corn. Journal of Wildlife Management 48:109–116.

Conover, M.R., W.C. Pitt, K.K. Kessler, T.J. Dubow, and W.A. Sanborn. 1995. Review of human injuries, illnesses and economic-based losses caused by wildlife in the United States. Wildl. Soc. Bull. 23:407-414.

Converse, K.A., and J.J. Kennelly. 1994. Evaluation of Canada goose sterilization for population control. Wildl. Soc. Bull. 22:265-269

Cooper, J. A., and T. Keefe. 1997. Urban Canada goose management: Policies and procedures. Tran. N. AM. Wildl. Nat. Resour. Conf. pp. 412-430.

CEQ. 2007. A citizen's guide to the NEPA. Council on Environmental Quality, Executive Office of the President. 55 pp.

Courchamp, F., R. Woodroffe, and G. Roemer. 2003. Removing protected populations to save endangered species. Science 302:1532.

Craig, J.R., J.D. Rimstidt, C.A. Bonnaffon, T.K. Collins, and P.F. Scanlon. 1999. Surface water transport of lead at a shooting range. Bull. Environ. Contam. Toxicol. 63:312–319.

Cramp, S., and K.E.L Simmons. 1977. Birds of the Western Palearctic, Vol. 1. Oxford University Press, Oxford, United Kingdom. 1,830 pp.

Cristol, D.A. 2001. American crows cache less-preferred walnuts. Animal Behaviour 62:331-336.

Cristol, D.A. 2005. Walnut-caching behavior of American crows. Journal of Field Ornithology 76:27-32.

Cummings, J.L., Glahn, J.E., Wilson, E.A., Davis Jr., J.E., Bergman, D.L., Harper, G.A., 1992. Efficacy and non-target hazards of DRC-1339 treated rice baits used to reduce roosting populations of depredating blackbirds in Louisiana. National Wildlife Research Control Report 481, 136 pp.

Cummings, J.L., P.A. Pochop, J.E. Davis, Jr., and H.W. Krupa. 1995. Evaluation of Rejex-It AG-36 as a Canada goose grazing repellent. Journal of Wildlife Management 59:47-50.

Cunningham, D.J. Cunningham, E.W. Schafer, Jr., and L.K. McConnell. 1979. DRC-1339 and DRC-2698 residues in starlings: preliminary evaluation of their secondary hazard potential. Proceedings of the Bird Control Seminar 8 (1979), pp. 31–37.

Cunningham, D.J., E.W. Schafer, and L.K. McConnell. 1981. DRC-1339 and DRC-2698 residues in European Starlings: preliminary evaluation of their effects on secondary hazard potential. Proc. Bird Control Semin. 8:31-37.

Cuthbert, F.J., L.R. Wires, and J.E. McKearon. 2002. Potential impacts of nesting double-crested cormorants on great blue herons and black-crowned nightherons in the U.S. Great Lakes Region. J. Great Lakes Res. 28: 145-154.

Darden T. 1974. Common grackle preying on fish. Wilson Bull. 86: 85–86.

Day, G.I., S.D. Schemnitz, and R.D. Taber. 1980. Capturing and marking wild animals. Pp. 61-88 *in* Wildlife management techniques manual, S.D. Schemnitz ed., The Wildlife Society, Inc. Bethesda, MD. 686 pp.

Decker, D.J., and L.C. Chase. 1997. Human dimensions of living with wildlife—a management challenge for the 21st century. Wildlife Society Bulletin 25:788–795.

Decker, D.J., and G.R. Goff. 1987. Valuing wildlife: Economic and social perspectives. Westview Press. Boulder, Colorado. 424 pp.

Decker, D.J., and K.G. Purdy. 1988. Toward a concept of wildlife acceptance capacity in wildlife management. Wildl. Soc. Bull. 16:53-57.

DeCino, T.J., D.J. Cunningham, and E.W. Schafer. 1966. Toxicity of DRC-1339 to European starlings. Journal of Wildlife Management 30:249-253.

DeHaven, R.W., and J.L. Guarino. 1969. A nest box trap for European starlings. Bird Banding 40:49-50.

De Jong, M.J. 1996. Northern Rough-winged Swallow (*Stelgidopteryx serripennis*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/234.

Dimmick, C.R., and L.K. Nicolaus. 1990. Efficiency of conditioned aversion in reducing depredation by crows. J. of Applied Ecology 27:200-209.

Dixon, W.J., and A.M. Mood. 1948. A method for obtaining and analyzing sensitive data. Journal of the American Statistical Association 43:109-126.

Dolbeer, R. A. 1994. Blackbirds. In: S. E. Hyngstrom, R. M. Timm, G. E. Larson, editors. Prevention and control of wildlife damage. Lincoln, Nebraska, USA: University of Nebraska Cooperative Extension Service. Pp E25-32.

Dolbeer, R.A. 1998. Population dynamics: the foundation of wildlife damage management for the 21st century. Pp. 2-11 *in* Barker, R. O. and Crabb, A. C., Eds. Eighteenth Vertebrate Pest Conference (March 2-5, 1998, Costa Mesa, California). University of California at Davis, Davis, California.

Dolbeer, R.A. 2000. Birds and aircraft: fighting for airspace in crowded skies. Proc. Vert. Pest Conf. 19:37-43.

Dolbeer, R.A. 2009. Birds and aircraft: Fighting for airspace in ever more crowded skies. Human-Wildlife Conflicts 3:165-166.

Dolbeer, R.A., and S.E. Wright. 2008. Wildlife strikes to civil aircraft in the United States,1990–2007. U.S. Department of Transportation, Federal Aviation Administration, Office of Airport Safety and Standards, Serial Report 14, Washington, D.C.

Dolbeer, R. A., P. P. Woronecki, A. R. Stickley, Jr., and S. B White. 1978. Agricultural impact of winter population of blackbirds and starlings. Wilson Bull. 90:31-44.

Dolbeer, R. A., P. P. Woronecki, and R. L. Bruggers. 1986. Reflecting tapes repel blackbirds from millet, sunflowers, and sweet corn. Wildlife Society Bulletin 14:418-425.

Dolbeer, R.A., J.L. Belant, and J.L. Sillings. 1993*a*. Shooting gulls reduces strikes with aircraft at John F. Kennedy International Airport. Wildlife Society Bulletin 21:442- 450.

Dolbeer, R.A., J.L. Belant, and L. Clark. 1993*b*. Methyl anthranilate formulations to repel birds from water at airports and food at landfills. Proc. Great Plains Wildl. Damage Contr. Workshop. 11:42-52.

Dolbeer, R. A., L. Clark, P. P. Woronecki, and T.W. Seamans. 1992. Pen tests of methyl anthranilate as a bird repellent in water. Proc. East. Wildl. Damage Control Conf. 5:112-116.

Dolbeer, R.A., T.W. Seamans, B.F. Blackwell, and J.L. Belant. 1998. Anthraquinone formulation (Flight Control) shows promise as avian feeding repellent. Journal of Wildlife Management 62:1558-1564.

Dolbeer, R.A., S.E. Wright, and E.C. Cleary. 2000. Ranking the hazard level of wildlife species to aviation. Wildlife Society Bulletin 28:372-378.

Dolbeer, R. A., S. E. Wright, J. Weller, and M. J. Beiger. 2012. Wildlife strikes to civil aircraft in the United States, 1990–2011. U.S. Department of Transportation, Federal Aviation Administration, Office of Airport Safety and Standards, Serial Report No. 18, Washington, D.C.

Dove C.J., N.F. Dahlan, and M. Heacker. 2009. Forensic birdstrike identification techniques used in an accident investigation at Wiley Post Airport, Oklahoma, 2008. Human Wildlife Conflicts 3:179–185.

Drilling N., R. Titman, and F. McKinney. 2002. Mallard (*Anas platyrhynchos)in* A. Poole and F. Gill, editors. The Birds of North America, The Academy of Natural Sciences, Philadelphia, Pennsylvania, and The American Ornithologists' Union, Washington, D.C.

Drury, W.H. 1973. Population changes in New England seabirds. Bird Banding 44:267-313.

Drury, W.H. 1974. Population changes in New England seabirds. Bird Banding 45:1-15.

Ducks Unlimited. 2012. American black duck. http://www.ducks.org/hunting/waterfowl-id/american-black-duck. Website accessed 12 April 2012.

Dykstra, C.R., J.L. Hays, and S.T. Crocoll. 2008. Red-shouldered Hawk (*Buteo lineatus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/107.

Ehrlich, P.R., D.S. Dobkin, and D. Wheye. 1988. The birders handbook: A field guide to the natural history of North American birds. Simon and Schuster, Inc. New York.

Elliot, H. N. 1964. Starlings in the Pacific Northwest. Vertebrate Pest Conference 2:29–39.

Environmental Data Center. 2008. University of Rhode Island Department of Natural Resources Science, College of Environmental and Life Sciences. Mallard (*Anas platyrhynchos*). http://www.edc.uri.edu/restoration/html/gallery/birds/mal.htm. Website accessed 7 May 2012.

Eisenmann, E. 1963. Is the black vulture migratory? Wilson Bull. 75:244-249.

Eisemann, J.D., P.A. Pipas, and J.L. Cummings. 2003. Acute and chronic toxicity of compound DRC-1339 (3-chloro-4-methylaniline hydrochloride) to birds. Pages 24-28 in G. M. Linz, editor. Proceedings of symposium on management of North American blackbirds. U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services, National WildlifeResearch Center, Fort Collins, Colorado.

EPA. 1982. Avian single-dose oral LD_{50} test, Guideline 71-1. Pp. 33-37 *in* Pesticide assessment guidelines, subdivision E, hazard evaluation wildlife and aquatic organisms. U. S. Environmental Protection Agency PB83-153908, Washington, D.C.

EPA. 1995. R.E.D. Facts - Starlicide (3-chloro-p-toluidine hydrochloride). US EPA, Prevention, Pesticides and Toxic Substances. EPA-738-F-96-003.

EPA. 1998. Anthraquinone (122701) Fact Sheet. http://www.epa.gov/pesticides/chem_search/reg_actions/ registration/fs_ PC-122701_01-Dec-98.pdf. Accessed May 9, 2013.

EPA. 1999. ECOFRAM terrestrial draft report. Ecological Committee on FIFRA Risk Assessment Methods. U. S. Environmental Protection Agency, Washington, D. C. http://www.epa.gov/oppefed1/ecorisk/terreport.pdf.

EPA. 2005. Pesticide Fact Sheet: Nicarbazin – Conditional Registration. United States Environmental Protection Agency, Office of Prevention, Pesticides, and Toxic Substances, Washington, DC 20460.

Eskildsen, U.K., and Vestergard-Jorgensen, P.E., 1973. On the possible transfer of trout pathogenic viruses by gulls. Rivista Italiana di Piscicultura e Ittiopatologia 8:104–105.

European Inland Fisheries Advisory Commission. 1989. Report of the EIFAC Working Party on prevention and control of bird predation in aquaculture and fisheries operations. EIFAC Tech. Pap. 51, Rome, Italy.

Farraway, A., K. Thomas, H. Blokpoel. 1986. Common Tern Egg Predation by Ruddy Turnstones'. The Condor 88:521-522.

Feare, C. 1984. The Starling. Oxford University Press. Oxford New York.

Feare, C., A. J. Isaacson, P. A. Sheppard, and J. M. Hogan. 1981. Attempts to reduce starling damage at dairy farms. Protection Ecol. 3:173-181.

Federal Aviation Administration. 2013. National wildlife strike database. Airport Wildlife Hazard Mitigation. FAA Technical Center, Atlantic City, NJ; Embry-Riddle Aeronautical University, Prescott, AZ. http://wildlife.pr.erau.edu/database/select_i.php Accessed April 30, 2013.

Felsenstein, W.C., R.P. Smith, and R.E. Gosselin. 1974. Toxicological studies on the avicide 3-chloro-ptoluidine. Toxicology and Applied Pharmacology 28:110-1125.

Fenlon, D.R. 1981. Seagulls (*Larus* spp.) as vectors of salmonellae: an investigation into the range of serotypes and numbers of salmonellae in gull faeces. Journal of Hyg., Camb. 86:195-202.

Fenwick, G. H. 1983. Feeding behavior of waterfowl in relation to changing food resources in the Chesapeake Bay, Dissertation, Johns Hopkins University, Baltimore, Marylan.

Fitzwater, W. D. 1994. House sparrows. Pp. E101–E108 *in* S. E. Hygnstrom, R. E. Timm, and G. E. Larson, editors. Prevention and Control of Wildlife Damage. University of Nebraska, Lincoln, Nebraska. http://digitalcommons.unl.edu/icwdmhandbook/. Accessed January 28, 2013.

Flux, J.E.C., and M.M. Flux. 1981. Population dynamics and age structure of starlings (Sturnus vulgaris) in New Zealand. New Zealand Journal of Ecology 4:65–72.

FDA. 2003. Bird poisoning of federally protected birds. Office of Criminal Investigations. Enforcement Story 2003.

Forbes, J. E. 1995. European Starlings are expensive nuisance on dairy farms. Ag. Impact 17:4.

Ford, H.S. 1967. Winter starling control in Idaho, Nevada, Oregon. Proceedings: Third Vertebrate Pest Conference 3:104-110.

Fuller-Perrine, L.D., and M.E. Tobin. 1993. A method for applying and removing bird exclusion netting in commercial vineyards. Wildlife Society Bulletin 21:47-51.

Fussell, J.O. 1994. A Birder's Guide to Coastal Connecticut. The University of Connecticut Press, 554 pp.

Gallien, P., and M. Hartung. 1994. Escherichia coli O157:H7 as a food borne pathogen. Pp 331-341 *in* Handbook of zoonoses. Section A: bacterial, rickettsial, chlamydial, and mycotic. G. W. Beran and J. H.Steele, eds. CRC Press. Boca Raton.

Gamble, L.R., K.M. Johnson, G. Linder, and E.A. Harrahy. 2003. The Migratory Bird Treaty Act and concerns for nontarget birds relative to spring baiting with DRC-1339. Pp 8-12 *in* G.M. Linz, ed. Management of North American blackbirds. National Wildlife Research Center, Fort Collins, Colorado.

Garrison, B.A. 1999. Bank Swallow (*Riparia riparia*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/414.

Giri, S.N., D.H. Gribble, and S.A. Peoples. 1976. Distribution and binding of radioactivity in starlings after IV administration of 14C 3-chloro-p-toluidine. Federation Proceedings 35:328.

Glahn, J.F. 1982. Use of starlicide to reduce starling damage at livestock feeding operations. Proc. Great Plains Wildl. Damage Control Workshop. 5:273-277.

Glahn, J.F. 1983. Blackbird and starling depredations at Tennessee livestock farms. Proc. Bird Control Semin. 9:125-134.

Glahn, J. F., and D. L. Otis. 1981. Approach for assessing feed loss damage by European Starlings at livestock feedlots. Pp. 38–45 *in* E. W. Schaefer, Jr., and C. R. Walker, eds. Vertebrate Pest Control and Management Materials: Third Conference, Special Technical Bulletin 752. American Society for Testing and Materials, West Conshohocken, Pennsylvania.

Glahn, J. F., and D. L. Otis. 1986. Factors influencing blackbird and European Starling damage at livestock feeding operations. Journal of Wildlife Management 50:15-19.

Glahn, J. F., and E. A. Wilson. 1992. Effectiveness of DRC-1339 baiting for reducing blackbird damage to sprouting rice. Proc. East. Wildl. Damage Cont. Conf. 5:117-123.

Glahn, J. F., S. K. Timbrook, and D. J. Twedt. 1987. Temporal use patterns of wintering European Starlings at a southeastern livestock farm: implications for damage control. Proc. East. Wildl. Damage Control Conf. 3:194-203.

Glahn, J.F., Wilson. E.A.. Avery. M. L. 1990. Evaluation of DRC- 1339 baiting program to reduce sprouting rice damage caused by spring roosting blackbirds. National Wildlife Research Control Report 448. 25 pp.

Glahn, J.F., E.S. Rasmussen, T. Tomsa, and K.J. Preusser. 1999*a*. Distribution and relative impact of avian predators at aquaculture facilities in the Northeastern United States. North American Journal of Aquaculture 61:340-348.

Glahn, J.F., T. Tomsa, and K.J. Preusser. 1999*b*. Impact of great blue heron predation at trout-rearing facilities in the Northeastern United States. North American Journal of Aquaculture 61:349-354.

Glahn, J.F., G. Ellis, P. Fiornelli, and B. Dorr. 2000. Evaluation of low to moderate power lasers for dispersing double-crested cormorants from their night roosts. Proceedings of the 9th Wildlife Damage Management Conference. 9:34-35.

Glahn, J.F., B. Dorr, J.B. Harrel, and L. Khoo. 2002. Foraging ecology and depredation management of great blue herons at Mississippi catfish farms. Journal of Wildlife Management 66:194–201.

Golab, A. 2012. Kayaker drowns after coming too close to swan. Chicago Sun-Times. http://www.suntimes.com/11923182-417/man-drowns-in-kayak-after-coming-too-close-to-swan.html. Website accessed 19 December 2012.

Goodrich, L.J., S.C. Crocoll, and S.E. Senner. 1996. Broad-winged Hawk (*Buteo platypterus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/218.

Gorenzel, W.P., and T.P. Salmon. 1993. Tape-recorded calls disperse American crows from urban roosts. Wildlife Society Bulletin 21:334-338.

Gorenzel, W.P., and T.P. Salmon. 1995. Characteristics of American crow urban roosts in California. Journal of Wildlife Management 59:638-645.

Gorenzel, W.P., T.P. Salmon, G.D. Simmons, B. Barkhouse, and M.P. Quisenberry. 2000. Urban crow roosts – a nationwide phenomenon? Proc. Wildl. Damage Manage. Conf. 9:158-170.

Gorenzel, W.P., B.F. Blackwell, G.D. Simmons, T.P. Salmon, and R.A. Dolbeer. 2002. Evaluation of lasers to disperse American crows, Corvus brachyrhynchos, from urban night roosts. International Journal of Pest Management 48:327–331.

Graczyk, T.K., M.R. Cranfield, R. Fayer, J. Tout, and J.J. Goodale. 1997. Infectivity of *Cryptosporidium parvum* oocysts is retained upon intestinal passage through a migratory waterfowl species (Canada goose, *Branta canadnsis*). Tropical Med. International Heal. 2:341-347.

Graczyk, T.K., R. Fayer, J.M. Trout, E.J. Lewis, C.A. Farley, I. Sulaiman, and A.A. Lal. 1998. *Giardia* sp. cysts and infectious *Cryptosporidium parvum* oocysts in the feces of migratory Canada geese (*Branta canadensis*). Applied and Environmental Microbiology 64:2736-2738.

Graves, G.E., and W.F. Andelt. 1987. Prevention and control of woodpecker damage. Service in Action, Colo. St. Univ. Coop. Ex. Serv. Publ. no 6.516. Ft. Collins, Colo. 2 pp.

Haines, A. M., M. J. McGrady, M. S. Martell, B. J. Dayton, M. B. Henke, and W. S. Seegar. 2003. Migration routes and wintering locations of Broad-winged Hawks tracked by satellite telemetry. Wilson Bulletin 115:166-169.

Hall, C.H., and P. Groninger. 2002. The effectiveness of a long-term Canada goose relocation program in Nevada. Proc. 20th Vertebr. Pest Conf. University of California, Davis, Davis, California. Pp. 180-186.

Hamel, P.B. 1992. The land manager's guide to the birds of the South. Chapel Hill, NC: The Nature Conservancy. 437 pp.

Hamilton, Jr., W.J. 1951. The food of nestling bronzed grackles, *Quiscalus quiscula versicolor*, in central New York. Auk 68:213-217.

Harris, H.J., Jr., J.A. Ladowski, and D.J. Worden, 1981. Water-quality problems and management of an urban waterfowl sanctuary. Journal of Wildlife Management 45:501–507.

Hatch, J.J. 1995. Changing populations of double-crested cormorants. Colonial Waterbirds 18 (Spec. Publ. 1): 8–24.

Hatch, J.J. 1996. Threats to public health from gulls (Laridae). Journal of Environmental Health Research 6:5-16.

Hatch, J.J., and D.V. Weseloh. 1999. Double-crested Cormorant (*Phalacrocorax auritus*) *in* A. Poole and F. Gill, editors. The Birds of North America, The Academy of Natural Sciences, Philadelphia, Pennsylvania, and The American Ornithologists' Union, Washington, D.C.

Hayman, P., J. Marchant, and T. Prater. 1986. Shorebirds: An identification guide to the waders of the world. Houghton Mifflin Company, Boston, Massachusetts. 412 pp.

Hebert, C. E., J. Duffe, D. V. C. Weseloh, E. M. T. Senese, G. D. Haffner. 2005. Unique island habitats may be threatened by double-crested cormorants. Journal of Wildlife Management 69:57-65.

Henny, C.J. 1990. Mortality. Pp. 140 - 151 In Birds of Prey. I. Newton, P. Olsen, and T. Pyrzalowski,eds. Facts on File, New York, New York. 240 pp.

Heusmann, H.W., and R. Bellville. 1978. Effects of nest removal on starling populations. Wilson Bull. 90:287-290.

Heusmann, H. W. and J. R. Sauer. 1997. A survey for mallard pairs in the Atlantic Flyway. Journal of Wildlife Management 61:1191–1198.

Heusmann, H. W. and J. R. Sauer. 2000. The northeast states' breeding waterfowl population survey. Wildlife Society Bulletin 28:355–364.

Hicks, R.E. 1979. Guano deposition in an Oklahoma crow roost. The Condor 81:247-250.

Hill, G.A., and D.J. Grimes. 1984. Seasonal study of freshwater lake and migratory waterfowl for *Campylobacter jejuni*. Canadian Journal of Microbiology 30:845-849.

Holler, N.R., and E.W. Schafer, Jr. 1982. Potential secondary hazards of Avitrol baits to sharp-shinned hawks and American kestrels. Journal of Wildlife Management 46:457-462.

Holevinski, R. A., P. D. Curtis, and R. A. Malecki. 2006. Can hunting of translocated nuisance Canada Geese reduce local conflicts? Wildlife Society Bulletin 34:845-849.

Holevinski, R.A., P.D. Curtis, and R.A. Malecki. 2007. Hazing of Canada geese is unlikely to reduce nuisance populations in urban and suburban communities. Human-Wildl. Conflicts 1:257-264.

Hothem, R.L., B.E. Brussee, and W.E. Davis, Jr. 2010. Black-crowned Night-Heron (*Nycticorax nycticorax*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/074.

Hunter, R.A., R.D. Morris. 1976. Nocturnal Predation by a Black-Crowned Night Heron at a Common Tern Colony. The Auk, Vol. 93, No. 3, pp. 629-633.

Ivan, J.S., and R.K. Murphy. 2005. What Preys on Piping Plover Eggs and Chicks? Wildlife Society Bulletin, Vol. 33, No. 1, pp. 113-119.

Jackson, J.A., and B.J.S. Jackson. 1995. The double-crested cormorant in the south-central United States: habitat and population changes of a feathered pariah. Colonial Waterbirds 18 (Spec. Publ. 1): 118-130.

Jamieson, R.L. 1998. Tests show Canada geese are cause of polluted lake water. Seattle Pilot. July 9, 1998. Seattle,Washington.

Jarvie, S. H. Blokpoel, and T. Chipperfield. 1999. A geographic information system to monitor nest distributions of double-crested cormorants and black-crowned night-herons at shared colony sites near Toronto, Canada. Pp 121-129 in (M.E. Tobin, Tech. Coord.). Symposium on double-crested cormorants: Population status and management issues in the Midwest. 9 December 1997, Milwaukee, WI. Tech. Bull. 1879. Washington, D.C.:U.S. Department of Agriculture, Animal and Plant Health Inspection Service.

Jensen, M.A. 1996. Overview of methods used to reduce gull, geese, raptor, and deer hazards to aircraft at O'Hare International Airport (abstract only). Proc. ann. Meeting Bird Strike Committee, USA.

Johnson, R. J. 1994. American crows. Pp. E33–E40 *in* S. E. Hygnstrom, R. E. Timm, and G. E. Larson, editors. Prevention and Control of Wildlife Damage. University of Nebraska, Lincoln, Nebraska. http://digitalcommons.unl.edu/icwdmhandbook/. Accessed May 9, 2013.

Johnson, R.J., and J.F. Glahn. 1994. European Starlings *in* S. E. Hygnstrom, R.M. Timm, and G.E. Larson, editors. Prevention and control of wildlife damage - 1994. Univ. NE Coop. Ext., Instit. o f Ag. and Nat. Res., Univ. of NE-Lincoln, USDA, APHIS, Animal Damage Control, Great Plains Ag. Council Wildl. Committee, pp 109 - 120.

Johnston, J. J., D. B. Hurlbut, M. L. Avery, and J. C. Rhyans. 1999. Methods for the diagnosis of acute 3-chloro-p-toluidine hydrochloride poisoning in birds and the estimation of secondary hazards to wildlife. Environ. Toxicology and Chemistry 18:2533-2537.

Jones, F., P. Smith, and D.C. Watson. 1978. Pollution of a water supply catchment by breeding gulls and the potential environmental health implications. Journal of the Institute of Water Engineering Science 32:469-482.

Kassa, H., B. Harrington, and M.S. Bisesi. 2001. Risk of occupational exposure to *Cryptosporidium, Giardia,* and *Campylobacter* associated with the feces of giant Canada geese. Appl. Occup. And Env. Hygiene 16:905-909.

Kaufman, K. 1996. Lives of North American Birds. Boston: Houghton Mifflin Company. 704 pp.

Keefe, T. 1996. Feasibility study on processing nuisance Canada geese for human consumption. Minnesota Department of Natural Resources, Section of Wildlife. 7 pp + 4 appendixes.

Kendall, R.J., T.E. Lacher, Jr., C. Bunck, B. Daniel, C. Driver, C.E. Grue, F. Leighton, W. Stansley, P.G. Watanabe, and M. Whitworth. 1996. An ecological risk assessment of lead shot exposure in non-waterfowl avian species: Upland game birds and raptors. Environ. Toxicol. and Chem. 15:4-20.

Kennamer, M.C. 2010. Eastern wild turkey (*Meleagris gallopavo silvestris*). National Wild Turkey Federation. Bulletin No. 1. http://www.nwtf.org/conservation/bulletins/bulletin_01.pdf. Accessed September 20, 2010.

Kessel, B. 1957. A study of the breeding biology of the European starling (Sturnus vulgaris) in North America. American Midland Naturalist 58:257–331.

Kilham, L. 1989. The American Crow and the Common Raven. Texas A&M Press, College Station, Texas. 255 pp.

Kirk, D.A., and M.J. Mossman. 1998. Turkey Vulture (*Cathartes aura*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/339.

Klett, B.R., D.F. Parkhurst, and F.R. Gaines. 1998. The Kensico Watershed Study: 1993 - 1995. http://www.epa.gov/owow/watershed/Proceed/sess41-60.pdf. Accessed November 24, 2009.

Klimstra, J. D., and P. I. Padding. 2012. Atlantic Flyway waterfowl harvest and population survey data, United States Fish and Wildlife Service, Division of Migratory Bird Management, Laurel, Maryland.

Knittle, C.E., and J.L. Guarino. 1976. Reducing a local population of European Starlings with nest-box traps. Proc. Bird Control. Semin. 7:65-66.

Knittle, C.E., E.W. Schafer, Jr., and K.A. Fagerstone. 1990. Status of compound DRC-1339 registration. Vertebr. Pest Conf. 14:311-313.

Knutsen, G.A. 1998. Avian use of rice-baited and unbaited stubble fields during spring migration in South Dakota. M.S. Thesis, North Dakota State University, Fargo, North Dakota, 160 pp.

Korfanty, C., W.G. Miyasaki, and J.L. Harcus. 1999. Review of the population status and management of double-crested cormorants in Ontario. Pp 131-145 *in* M.E. Tobin, Tech. Coord. Symposium on double-crested cormorants: Population status and management issues in the Midwest. 09 December 1997, Milwaukee, WI. Tech. Bull. 1879. Washington, D.C.: U.S. Department of Agriculture, Animal and Plant Health Inspection Service.

Kreeger, T.J., U.S. Seal, and J.R. Tester, 1988. The Pathophysiological Response of Red Fox (*Vulpes vulpes*) to Padded, Foothold Traps (Draft). University of Minnesota for the Fur Institute of Canada, St. Paul, Minnesota, March 6, 1988.

Kreps, L.B. 1974. Feral pigeon control. Proc. Vertebr. Pest. Conf. 6:257-262.

Laidlaw, M.A., H.W. Mielke, G.M. Filippelli, D.L. Johnson, and C.R. Gonzales. 2005. Seasonality and children's blood lead levels: Developing a predictive model using climatic variables and blood lead data from Indianapolis, Indiana, Syracuse, New York, and New Orleans, Louisiana (USA). Environ. Health Persp. 113:793-800.

Larsen, K.H., and D.F. Mott. 1970. House finch removal from a western Oregon blueberry planting. Murrelet 51:15-16.

Leck, C.F. 1984. The status and distribution of New Jersey's birds. New Brunswick, New Jersey, Rutgers University Press.

LeJeune, J. T., J. Homan, G. Linz, and D. L. Pearl. 2008. Role of the European starling in the transmission of E. coli O157 on dairy farms. Proceedings of the Vertebrate Pest Conference 23:31–34.

Lemmon, C.R., G. Burgbee, and G.R. Stephens. 1994. Tree damage by nesting double-crested cormorants in Connecticut. Connecticut Warbler 14:27-30.

Lewis, H.F. 1929. The Natural History of the Double-crested Cormorant. Ph.D. Dissertation, Cornell University, Ithaca, New York.

Link, W. A., and J. R. Sauer. 1998. Estimating population change from count data: application to the North American Breeding Bird Survey. Ecological Applications 8: 258–268.

Link, W. A. and J. R. Sauer. 2002. A hierarchical model of population change with application to Cerulean Warblers. Ecology 83: 2832-2840.

Linnell, M.A., M.R. Conover, and T.J. Ohashi. 1996. Analysis of bird strikes at a tropical airport. Journal of Wildlife Management 60:935-945.

Linz, G.M., D.L. Bergman, H.J. Homan, and W.J. Bleier. 1999. Effects of herbicide induced habitat alterations on blackbird damage to sunflower. Crop Protection 14:625–629.

Linz, G.M., D.A. Schaaf, R.L. Wimberly, H.J. Homan, T.L. Pugh, B.D. Peer, P. Mastrangelo, and W.J. Bleier. 2000. Efficacy and potential nontarget impacts of DRC-1339 avicide use in ripening sunflower fields: 1999 progress report. Pp. 162-169 *in* L. Kroh, ed.Proceedings of the 22nd Sunflower Research Workshop. (January 18-19, 2000, Fargo, North Dakota). National Sunflower Association, Bismarck, North Dakota.

Linz, G.M., H.J. Homan, S.M. Gaukler, L.B.Penry, and W.J. Bleier. 2007. European Starlings: a Review of an Invasive Species with Far-reaching Impacts. Managing Vertebrate Invasive Species: Proceedings of an International Symposium (eds. G.W. Witmer, W.C. Pitt & K.A. Fagerstone), pp. 378–386. USDA/APHIS/WS, National Wildlife Research Center, Fort Collins, Colorado.

Lipnick, R., J.A. Cotrouvo, R.N. Hill, R.D. Bruce, D.A. Stitzel, A.P. Walker, I. Chu, M. Goddard, L. Segal, J.A. Springer, and R.C. Meyers. 1995. Comparison of the Up-and-Down, conventional LD_{50}, and Fixed-Dose Acute Toxicity procedure. Food Chemistry and Toxicology 33:223-331.

Locke, L.N. 1987. Chlamydiosis. Pages 107-113 *in* M. Friend and C. J. Laitman, editors. Field Guide to Wildlife Diseases: General Field Procedures and Diseases Migratory Birds. M. Friend (ed.). U. S. Department of the Interior, Fish and Wildlife Service, Washington, D. C. Resource Publication 167. 225 pp.

Longcore, J.R., D.G. Mcauley, G.R. Hepp, and J.M. Rhymer. 2000. American Black Duck (*Anas rubripes*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/481.

Lovell, H.B. 1947. Black vultures kill young pigs in Kentucky. Auk 64:131-132.

Lovell, H.B. 1952. Black vulture depredations at Kentucky woodlands. Auk 64:48-49.

Lowney, M.S. 1999. Damage by black and Turkey Vultures in Virginia, 1990-1996. Wildlife Society Bulletin 27:715-719.

Lowther, P.E. 1993. Brown-headed cowbird (*Molothrus ater*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/047.

Lowther, P.E., and C.L. Cink. 2006. House Sparrow (*Passer domesticus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/012.

Luechtefeld, N.W., M.J. Blaser, L.B. Reller, and W.L.L. Wang. 1980. Isolation of *Campylobacter fetus* subsp. *Jejuni* from migratory waterfowl. J. Clin. Microbiol. 12:406-408.

MacDonald, J.W. and P.D. Brown. 1974. *Salmonella* infection in wild birds in Britain. Veterinary Record 94: 21-322.

MacKinnon, B., R. Sowden, and S. Dudley, editors. 2001. Sharing the skies: an aviation guide to the management of wildlife hazards. Transport Canada, Aviation Publishing, Ottawa, Ontario, Canada.

Marzluff, J. M., R. Bowman, and R. Donnelly. 2001. A historical perspective on urban bird research: trends, terms, and approaches. Pages 1–17 *in* J. M. Marzluff, R. Bowman, and R. Donnelly, editors. Avian ecology and conservation in an urbanizing world. Kluwer Academic Publishers, Boston, Massachusetts.

Mason, J.R. 1989. Avoidance of methiocarb-poisoned apples by Red-winged Blackbirds. Journal of Wildlife Management 53:836-840.

Mason, J.R., and L. Clark. 1992. Non-lethal repellents: the development of cost-effective, practical solutions to agricultural and industrial problems. Proc. Vertebr. Pest Conf. 15:115-129.

Mason, J.R., A.H. Arzt, and R.F. Reidinger. 1984. Evaluation of dimethylanthranilate as a nontoxic starling repellent for feedlot settings. Proc. East. Wildl. Damage Control Conf. 1:259-263.

Mason, J.R., M.A. Adams, and L. Clark. 1989. Anthranilate repellency to European starlings: chemical correlates and sensory perception. Journal of Wildlife Management 53:55-64.

Massachusetts Audubon. 2012. Grackles and Swimming Pools. http://www.massaudubon.org/Nature_Connection/wildlife/index.php?subject=Birds:%20Behavior&id=15. Website accessed 27 April 2012.

Master, T.L. 1992. Mute Swan. *in* Atlas of Breeding Birds in Pennsylvania. Daniel W. Brauning, editor. University of Pittsburg Press, Pittsburgh, PA. pp 64-65.

Matteson, R.E. 1978. Acute oral toxicity of DRC-1339 to cardinals (*Cardinalis cardinalis*). U. S. Fish and Wildlife Service, Denver Wildlife Research Center, Bird Damage Research Report 84. 3 pp.

McCracken, H.F. 1972. Starling control in Sonoma County. Proc. Vertebr. Pest Conf. 5:124-126.

McGowan, K.J. 2001. Fish Crow (*Corvus ossifragus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/589.

MANEM Regional Waterbird Working Group. 2006. Waterbird Conservation Plan: 2006–2010 Mid-Atlantic / New England / Maritimes Region. A plan for the Waterbird Conservation for the Americas Initiative. http://www.waterbirdconservation.org/pdfs/regional/manem_binder_appendix_1b.pdf. Accessed December 11, 2012.

Miller, J.W. 1975. Much ado about European starlings. Nat. Hist. 84:38-45.

Mitterling, L.A. 1965. Bird damage on apples. Proceedings of the American Society of Horticultural Science 87: 66–72.

Monaghan, P., C.B. Shedden, C.R. Fricker, and R.W.A. Girdwood. 1985. *Salmonella* carriage by herring gulls in the Clyde area of Scotland in relation to their feeding ecology. Journal of Applied Ecology 22:669-680.

Mortality and Morbidity Weekly Report. 2004. Outbreak of histoplasmosis among industrial plant workers-Nebraska, 2004. Centers for Disease Control and Prevention. 53:1020-1022.

Mott, D.F. 1985. Dispersing blackbird-starling roosts with helium-filled balloons. Proc. East. Wildl. Damage Conf. 2:156-162.

Mott, D.F., and C.P. Stone. 1973. Bird damage to blueberries in the United States. U.S. Bur. Sport Fisheries and Wildlife, Spec. Sci. Rept., Wildl. No. 172. 15 pp.

Mott, D.F., J.F. Glahn, P.L. Smith, D.S. Reinhold, K.J. Bruce, and C.A. Sloan. 1998. An evaluation of winter roost harassment for dispersing double-crested cormorants away from catfish production areas in Mississippi. Wildlife Society Bulletin 26:584-591.

Mott, D.F., and S.K. Timbrook. 1988. Alleviating nuisance Canada goose problems with acoustical stimuli. Proc. Vertebr. Pest. Conf. 13:301-305.

Muller, L.I., R.J. Warren, and D.L. Evans. 1997. Theory and practice of immunocontraception in wild animals. Wildl. Soc. Bull. 25:504-514.

NAS. 2010. The Christmas Bird Count Historical Results. www.audubon.org/bird/cbc. Accessed on 11 April 2012.

NAS. 2012. National Audubon Society American Black Duck. http://www.audubon.org/species/amebla. Website accessed on 12 April 2012.

NASS. 2009. 2007 Census of Agriculture. USDA, National Agricultural Statistics Service, Washington, DC. http://www.agcensus.usda.gov/Publications/ 2007/Full_Report/. Released February 4, 2009. Website accessed 3 May 2012.

NASS. 2011. Cattle Death Loss. http://usda.mannlib.cornell.edu/usda/current/CattDeath/CattDeath-05-12-2011.pdf. Released May 12, 2011. Website accessed 30 April 2013.

National Wild Turkey Federation. 2010. All about wild turkeys. http://www.nwtf.org/for_hunters/all_about_turkeys.html. Accessed September 23, 2010.

Nehls, H. 2002. Monk Parakeets. Audubon Warbler 66:26.

Newman, J.R., C.M. Newman, J.R. Lindsay, B. Merchant, M.L. Avery, and S. Pruett-Jones. 2004. Monk Parakeets: an Expanding Problem on Power Lines and Other Electrical Utility Structures. The 8th International Symposium on Environmental Concerns in Rights-of-way Management. Saratoga Springs, New York.

Nielsen, L. 1988. Definitions, considerations, and guidelines for translocation of wild animals. Pp 12-51 in L. Nielsen and R. D. Brown, eds. Translocation of wild animals. Wis. Humane Soc., Inc., Milwaukee and Caesar Kleberg Wildl. Res. Inst., Kingsville, TX. 333pp. Norton, R.L. 1986. Case of botulism in laughing gulls at a landfill in the Virgin Islands, Greater Antilles. Florida Field Naturalist 14:97-98.

Norton, R.L. 1986. Case of botulism in laughing gulls at a landfill in the Virgin Islands, Greater Antilles. Florida Field Naturalist 14:97-98.

Olesen, N.J., and P.E. Vestergard-Jorgensen. 1982. Can and do herons serve as vectors for Egtved virus? Bull. Eur. Assoc. Fish Pathol. 2:48.

Otis, D.L., J.H. Schulz, D. Miller, R.E. Mirarchi, and T.S. Baskett. 2008. Mourning Dove (*Zenaida macroura*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/117.

Pacha, R.E., G.W. Clark, E.A. Williams, and A.M. Carter. 1988. Migratory birds of central Washington as reservoirs of Campylobacter jejuni. Can. J. Micro. 34:80-82.

Palmer, R.S. 1988. Handbook of North American birds. Vol. 4: Diurnal Raptors (Part 1)Yale University Press, New Haven, Connecticut.

Palmer, T.K. 1970. House finch (linnet) control in California. Proceedings of the fourth vertebrate pest conference 4:173-178.

Parkhurst, J.A., R.P. Brooks, and D.E. Arnold. 1987. A survey of wildlife depredation and control techniques at fish-rearing facilities. Wildl. Soc. Bull. 15:386-394.

Parkhurst, J.A., R.P. Brooks, and D.E. Arnold. 1992. Assessment of predation at trout hatcheries in central Pennsylvania. Wildl. Soc. Bull. 20:411-419.

Peer, B. D., and E.K. Bollinger. 1997. Common Grackle (*Quiscalus quiscula*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/271.

Peters, F., and M. Neukirch. 1986. Transmission of some fish pathogenic viruses by the heron, *Ardea cinerea*. Journal of Fish Diseases T986, 9:539–544.

Peterson, R.T. 1980. Eastern Birds. Houghton Mifflin Co., Boston, Massachusetts.

Peoples, S.A., and A. Apostolou. 1967. A comparison between the metabolism of DRC-1339 in rabbits and in starlings. Progress report on starling control. University of California, Davis.

Plesser, H., S. Omasi, and Y. Yom-Tov. 1983. Mist nets as a means of eliminating bird damage to vineyards. Crop Protection 2:503-506.

Pochop, P.A. 1998. Comparison of white mineral oil and corn oil to reduce hatchability of ring-billed gull eggs. Proc. Vertebr. Pest Conf. 18:411-413.

Pochop, P.A., J.L. Cummings, J.E. Steuber, and C.A. Yoder. 1998. Effectiveness of several oils to reduce hatchability of chicken eggs. Journal of Wildlife Management 62:395-398.

Poole, A.F., Rob O. B., and M.S. Martell. 2002. Osprey (*Pandion haliaetus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/683.

Portnoy, J.W. 1990. Gull contributions of phosphorous and nitrogen to a Cape Cod kettle pond. Hydrobiologia 202:61-69.

Preston, C. R. and R. D. Beane. 2009. Red-tailed Hawk (*Buteo jamaicensis*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/052.

Pressuer, S.E., T.W. Seamans, A.L. Gosser, and R.B. Chipman. 2008. Evaluation of an integrated non-lethal Canada goose management program in New York (2004-2006). Proc. Vertebr. Pest Conf. 23:66-73.

Price, I.M., and J.G. Nickum. 1995. Aquaculture and birds: the context for controversy. Colonial Waterbirds 18:33–45.

Pruett-Jones, S., J. R. Newman, C. M. Newman, M. L. Avery, and J. R. Lindsay. 2007. Population viability analysis of monk parakeets in the United States and examination of alternative management strategies. Human-Wildlife Conflicts 1:35–44.

Quessey, S., and S. Messier. 1992. Prevalence of *Salmonella* spp., *Campylobacter* spp. and *Listeria* spp. in ring-billed gulls (*Larus delawarensis*). Journal of Wildlife Disease 28:526-531.

Rabenhold, P.P., and M.D. Decker. 1989. Black and turkey vultures expand their ranges northward. The Eyas. 12:11-15.

Raftovich, R.V., K.A. Wilkins, S.S Williams, H.L. Spriggs, and K.D. Richkus. 2011. Migratory bird hunting activity and harvest during the 2009 and 2010 hunting seasons. U.S. Fish and Wildlife Service, Laurel, Maryland.

Raftovich, R.V., K.A. Wilkins, S.S. Williams, and H.L. Spriggs. 2012. Migratory bird hunting activity and harvest during the 2010 and 2011 hunting seasons. U.S. Fish and Wildlife Service. Laurel, Maryland.

Reilly, W.G., G.I. Forbes, G.M. Paterson, and J.C.M. Sharp. 1981. Human and animal salmonellosis in Scotland associated with environmental contamination, 1973-1979. Veterinary Record 108:553-555.

Reinhold, D.S., and C.A. Sloan.1999. Strategies to reduce double-crested cormorant depredation at aquaculture facilities in Mississippi. Pg 99-105 *in* M.E. Tobin, ed. Symposium on double-crested cormorants: Population status and management issues in the Midwest. 9 December 1997, Milwaukee, WI. Tech. Bull. 1879. Washington, D.C.

RIDEM. 2006. Mute Swan Management Plan. http://www.dem.ri.gov/programs/bnatres/fishwild/ pdf/ muswan07.pdf. Accessed online 4 May 2012.

RIDEM. 2012*a*. Fish and Wildlife Staff. http://www.dem.ri.gov/programs/ bnatres/fishwild/staff.htm. Website accessed 3 May 2012.

RIDEM. 2012*b*. Crow and Raven Fact Sheet. http://www.dem.ri.gov/programs/bnatres/fishwild/crowravn.htm. Website accessed 26 April 2012.

RIDEM. 2012c. 2012 - 2013 Rhode Island Hunting and Trapping Abstract. Rhode Island Department of Environmental Management, Division of Fish and Wildlife. West Kingston, Rhode Island. http://www.dem.ri.gov/pubs/regs/regs/fishwild/hunt1213.pdf. Accessed April 30, 2013.

Rich, T. D., C. J. Beardmore, H. Berlanga, P. J. Blancher, M. S. W. Bradstreet, G. S. Butcher, D. W. Demarest, E. H. Dunn, W. C. Hunter, E. E. Iñigo-Elias, J. A. Kennedy, A. M. Martell, A. O. Panjabi, D. N. Pashley, K. V. Rosenberg, C. M. Rustay, J. S. Wendt, and T. C. Will. 2004. Partners in Flight North American Landbird Conservation Plan. Cornell Lab of Ornithology. Ithaca, New York.

Rimmer, D.W., and R.D. Deblinger. 1990. Use of Predator Exclosures to Protect Piping Plover Nests. Journal of Field Ornithology, Vol. 61, No. 2, pp. 217-223.

Robbins, C. S. 1973. Introduction, spread, and present abundance of the house sparrow in North America. Ornithol. Monogr. 14:3-9.

Robbins, C.S., and E.A.T. Blom. 1996. Atlas of the Breeding Birds of Maryland and the District of Columbia. University of Pittsburgh Press, Pittsburgh, Pennsylvania.

Robinson, M. 1996. The potential for significant financial loss resulting from bird strikes in or around an airport. Proc. Bird Strike Committee Europe 22:353-367.

Roffe, T.J. 1987. Avian tuberculosis. Pp. 95-99 *in* M. Friend and C. J. Laitman, eds. Field guide to wildlife diseases. 225 pp.

Rogers, J. G., Jr., and J. T. Linehan. 1977. Some aspects of grackle feeding behavior in newly planted corn. Journal of Wildlife Management 41:444-447.

Rossbach, R. 1975. Further experiences with the electroacoustic method of driving European Starlings from their sleeping areas. Emberiza 2:176-179.

Rowsell, E.V., J.A. Carnie, S.D. Wahbi, A.H. Al-Tai, and K.V. Rowsell. 1979. L-serine dehydratase and L-serine-pyruvate aminotransferase activities in different animal species. Comp. Biochem. Physiol. B Comp. Biochem. 63:543-555.

Royall, W.C., Jr. 1966. Breeding of the starling in central Arizona. Condor 68:195–205.

Royall, W.C., T.J. DeCino, and J.F. Besser. 1967. Reduction of a Starling Population at a Turkey Farm. Poultry Science. Vol. XLVI No. 6. pp 1494-1495.

Rudstam, L.G., A.J. VanDeValk, C.M. Adams, J.T.H. Coleman, J.L. Forney, and M.E. Richmond. 2004. Cormorant predation and the population dynamics of walleye and yellow perch in Oneida Lake. Ecological Applications 14:149-163.

Saltoun, C.A., K.E. Harris, T.L. Mathisen, and R. Patterson. 2000. Hypersensitivity pneumonitis resulting from community exposure to Canada goose droppings: when an external environmental antigen becomes an indoor environmental antigen. Annal. Allergy Asth. Immun. 84:84-86.

Sauer, J. R., and W. A. Link. 2011. Analysis Of The North American Breeding Bird Survey Using Hierarchical Models. The Auk 128:87-98.

Sauer, J. R., J. E. Hines, J. E. Fallon, K. L. Pardieck, D. J. Ziolkowski, Jr., and W. A. Link. 2012. The North American Breeding Bird Survey, Results and Analysis 1966-2011. Version 12.13.2011 USGS Patuxent Wildlife Research Center, Laurel, Maryland.

Schafer, E.W., Jr. 1972. The acute oral toxicity of 369 pesticidal, pharmaceutical, and other chemicals to wild birds. Toxicol. Appl. Pharmacol. 21, 315.

Schafer, E.W., Jr. 1981. Bird control chemicals - nature, modes of action, and toxicity. Pp 129-139 *in* CRC handbook of pest management in agriculture. Vol. 3. CRC Press, Cleveland, Ohio.

Schafer, E.W., Jr. 1984. Potential primary and secondary hazards of avicides. Proc. Vert. Pest Conf. 11:217-222.

Schafer, E.W., Jr. 1991. Bird control chemicals-nature, mode of action and toxicity. Pp 599-610 *in* CRC Handbook of Pest Management in Agriculture Vol. II. CRC Press, Cleveland, Ohio.

Schafer, E. W., Jr., and D. J. Cunningham. 1966. Toxicity of DRC-1339 to grackles and house finches. U. S. Fish and Wildl. Serv. Denver Wildlife Research Center, Typed Rept. 1 pp.

Schafer, E.W., Jr., R.B. Brunton, and N.F. Lockyer. 1974. Hazards to animals feeding on blackbirds killed with 4-aminopyrine baits. Journal of Wildlife Management 38:424-426.

Schafer, E.W., Jr., R.B. Brunton, D.J. Cunningham, and N.F. Lockyer. 1977. The chronic toxicity of 3-chloro-4-methyl benzamine HCl to birds. Archives of Environmental Contamination and Toxicology 6:241-248.

Scherer, N.M., H.L. Gibbons, K.B. Stoops, and M. Muller, 1995. Phosphorus loading of an urban lake by bird droppings. Lake and Reservoir Management 11:317–327.

Schmidt, R. 1989. Wildlife management and animal welfare. Trans. N.Amer. Wildl. And Nat. Res. Conf. 54:468-475.

Schmidt, R.H., and R.J. Johnson. 1984. Bird dispersal recordings: an overview. ASTM STP 817. 4:43-65.

Seamans, T. W. 2004. Response of roosting turkey vultures to a vulture effigy. Ohio Journal of Science 104:136–138.

Seamans, T.W., D.W. Hamershock, and G.E. Bernhardt. 1995. Determination of body density for twelve bird species. Ibis 137:424-428.

Seamans, M. E., R. D. Rau, and T. A. Sanders. 2012. Mourning dove population status, 2012. U.S. Department of the Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Washington, D.C.

Shieldcastle, M.C., and L. Martin. 1999. Colonial waterbird nesting on west sister island national wildlife refuge and the arrival of double-crested cormorants. Pp 115-119 in M.E. Tobin, Tech. Coord. Symposium on double-crested cormorants: Population status and management issues in the Midwest. 9 December 1997., Milwaukee, WI. Tech. Bull. 1879. Washington, D.C.: U.S. Department of Agriculture, Animal and Plant Health Inspection Service.

Shirota, Y.M., and S. Masake. 1983. Eyespotted balloons are a device to scare gray European Starlings. Appl. Ent. Zool. 18:545-549.

Shwiff, S., and T. Devault. 2009. The economic impact of double-crested cormorants to Central New York. Unpublished report. National Wildlife Research Center, USDA/APHIS/WS, Fort Collins, Colorado.

Sibley, F.C. 1994. Double-crested Cormorant *Phalacrocorax auritus*. In The Atlas of Breeding Birds of Connecticut. L.R. Bevier, ed. State Geological and Natural History Survey of Connecticut, Department of Connecticut.

Simmons, G.M., Jr., S.A. Herbein, and C.M. James. 1995. Managing nonpoint fecal coliform sources to tidal inlets. Universities Council on Water Resources. Water Resour. Update 100:64–74.

Slate, D.A., R. Owens, G. Connolly, and G. Simmons. 1992. Decision making for wildlife damage management. Trans. N. A. Wildl. Nat. Res. Conf 57:51-62.

Smith, J.A. 1999. Nontarget avian use of DRC-1339 treated plots during an experimental blackbird control program in eastern South Dakota. M.S. Thesis, South Dakota State University, Brookings, South Dakota.

Smith, A.E., S.R. Craven, and P.D. Curtis. 1999. Managing Canada geese in urban environments. Jack Berryman Institute Publication 16, and Cornell University Cooperative Extension, Ithaca, N.Y. 42 pp.

Spreyer, M.F., and E.H. Bucher. 1998. Monk Parakeet (*Myiopsitta monachus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/322.

Stafford, T. 2003. Pest Risk Assessment for the Monk Parakeet in Oregon. Oregon Department of Agriculture. Salem, OR. Online http://www.oregon.gov/OISC/docs/pdf/monkpara.pdf?ga=t Website accessed 9 March 2012.

Stansley W., L. Widjeskog, and D.E. Roscoe. 1992. Lead contamination and mobility in surface water at trap and skeet ranges. Bulletin of Environmental Contamination and Toxicology 49, pp. 640–647.

Sterner, R.T., D.J. Elias, and D.R. Cerven. 1992. The pesticide reregistration process: collection of human health hazards data for 3-chloro-p-toluidine hydrochloride (DRC-1339). Pp. 62-66 *in* J. E. Borrecco and R. E. Marsh, eds., Proceedings 15th Vertebrate Pest Conference, March 3-5, 1992, Newport Beach, California.

Sterritt, R.M., and J.N. Lester. 1988. Microbiology for environmental and public health engineers. E. & F. N. Spon, Ltd., New York.

Stone, C.P., and D.F. Mott. 1973. Bird damage to ripening field corn in the United States, 1971. U.S. Bureau of Sport Fisheries and Wildlife, Wildlife Leaflet 505. 8 pp.

Stroud, R. K., and M. Friend. 1987. Salmonellosis. Pp 101-106 *In* Field Guide to Wildlife Diseases: General Field Procedures and Diseases of Migratory Birds. M. Friend (ed.). U. S. Department of the Interior, Fish and Wildlife Service, Washington, D. C. Resource Publication 167. 225 pp.

Sullivan, B.D., and J.J. Dinsmore. 1990. Factors affecting egg predation by American Crows. Journal of Wildlife Management 54:433-437.

Swift, B. 1998. Response of resident Canada geese to chasing by trained border collies. New York State Dept. of Environmental Conservation, Bureau of Wildlife, Wildlife Research Center. Delmar, N.Y. Unpublished report. 6 pp.

Tahon, J. 1980. Attempts to control starlings at roosts using explosives. *in* Bird problems in agriculture. E.N. Wright, I.R. Inglis, and C.J. Feare (eds.). British Crop Protection Council, Croydon, U.K. 210 pp.

Tarof, S., and C.R. Brown. 2013. Purple Martin (*Progne subis*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/287.

Taylor, P.W. 1992. Fish-eating birds as potential vectors of *Edwardsiella ictaluri*. Journal of Aquatic Animal Health 4:240–243.

Tefft, B. 2009. Species Spotlight: Eastern Wild Turkey. Wild Rhode Island, Vol. 2, Issue 2. RIDEM Division of Fisheries and Wildlife.

Tefft, B. 2012. 2011 Rhode Island Wild Turkey Status Report. http://www.dem.ri.gov/programs/bnatres/fishwild/pdf/trkystat.pdf. Accessed online 23 January 2013.

The Wildlife Society. 1992. Conservation policies of the Wildlife Society. The Wildlife Society. Washington, D.C. 20 pp.

Thorpe, J. 1996. Fatalities and destroyed civil aircraft due to bird strikes: 1912-1995. Proc. Int. Bird Strike Conf. 23:17-31.

Tillman, E.A., A.C. Genchi, J.R. Lindsay, J.R. Newman, and M.L. Avery. 2004. Evaluation of trapping to reduce Monk Parakeet populations at electric utility facilities. Vertebrate Pest Conference 21:126–129.

Tobin, M.E., D.T. King, B.S. Dorr, and D.S. Reinhold. 2002. The effect of roost harassment on cormorant movements and roosting in the Delta region of Mississippi. Waterbirds 25:44-51.

Tobin, M.E., P.P. Woronecki, R.A. Dolbeer, and R.L. Bruggers. 1988. Reflecting tape fails to protect ripening blueberries from bird damage. Wildlife Society Bulletin 16:300-303.

Twedt, D.J., and J.F. Glahn. 1982. Reducing starling depredations at livestock feeding operations through changes in management practices. Proc. Vertebr. Pest Conf. 10:159-163.

Tyson, L.A., J.L. Belant, F J. Cuthbert, and D.V. Weseloh. 1999. Nesting populations of double-crested cormorants in the United States and Canada. Pp. 17-25. Symposium on Double-crested Cormorants: Population Status and Management Issues in the Midwest, December 9, 1997, M. E. Tobin, ed. USDA Technical Bulletin No. 1879. 164 pp.

United States Army Corps of Engineers. 2009. Predation Management Plan for Least Tern and Piping Plover Habitat along the Missouri River. Missouri River Recovery Integrated Science Program.

United States Air Force. 2012. Top 50 USAF Wildlife Strikes by Count, FY 1995-FY 2011. http://www.afsec.af.mil/shared/media/document/AFD-080130-041.pdf. Accessed online 10 May 2012.

USDA. 1999. Fruit Wildlife Damage. United States Department of Agriculture, National Agricultural Statistics Service, Agricultural Statistics Board, Washington, D.C. 5 pp.

USDA. 2001. Compound DRC-1339 Concentrate-Staging Areas. Tech Note. USDA/APHIS/WS. National Wildlife Research Center, Fort Collins, Colorado.

USDA. 2003. Tech Note: Spring viremia of carp. United States Department of Agriculture, Animal and Plant Protection Service, Veterinary Services. Riverdale, MD.

USDA. 2008. Environmental Assessment: Reducing Gull Damage through an Integrated Wildlife Damage Management Program in the State of Rhode Island. United States Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services, Amherst, Massachusetts.

USDA. 2009. Rhode Island: 2009 State Agriculture Overview. United States Department of Agriculture, Connecticut Agricultural Statistics Service. Concord, New Hampshire.

USDA. 2010. Environmental Assessment: Canada Goose Damage Management in the State of Rhode Island. United States Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services, Amherst, Massachusetts.

USFWS. 1981. Domestic Pigeon. United States Department of Interior, United States Fish and Wildlife Service. 4 pp.

USFWS. 1995. Report to Congress: Great Lakes Fishery Resources Restoration Study. 236 pp.

USFWS. 2000. North American Bird Conservation Initiative. U.S. North American Bird Conservation Initiative Steering Committee. Arlington, Virginia.

USFWS. 2001. Inside Region 3: Ohio man to pay more than $11,000 for poisoning migratory birds. Volume 4(2):5.

USFWS. 2003. Final Environmental Impact Statement: Double-crested cormorant management. U.S. Dept. of the Interior, USFWS, Div. of Migratory Bird Management, 4401 N. Fairfax Drive MS 634, Arlington, VA 22203.

USFWS. 2007. Final Environmental Impact Statement: Light goose management. United States Fish and Wildlife Service, Division of Migratory Birds. Arlington, Virginia. Accessed on November 12, 2010.

USFWS. 2009. Environmental Assessment: Extended management of double-crested cormorants under 50 CFR 21.47 and 21.48. United States Fish and Wildlife Service, Division of Migratory Bird Management, 4401 N. Fairfax Drive, Mail Stop 4107, Arlington, Virginia 22203.

USFWS. 2010. Final Environmental Assessment: Proposal to permit take as provided under the Bald and Golden Eagle Protection Act. United States Fish and Wildlife Service, Division of Migratory Bird Management. Arlington, Virginia.

USFWS. 2012. Division of Migratory Bird Management. Mid-winter Waterfowl Survey. https://migbirdapps.fws.gov/. Website accessed 7 May 2012.

United States Geological Survey. 2005. Ospreys in Oregon and the Pacific Northwest. United States Geological Survey. http://fresc.usgs.gov/products/fs/fs-153-02.pdf. Accessed September 28, 2009.

Van Bael, S., and S. Pruett-Jones. 1996. Exponential population growth of monk parakeets in the United States. Wilson Bulletin 108:584-588.

VanDeValk, A. J., C. M. Adams, L. G. Rudstam, J. L. Forney, T. E. Brooking, M. Gerken, B. Young, and J. Hooper. 2002. Comparison of angler and cormorant harvest of walleye and yellow perch in Oneida Lake, New York. Transactions of the American Fisheries Society 131:27-39.

Vauk-Hentzelt, E., W. Gunkel, and K. Klings. 1987. Microbial diseases in special consideration of Coli septicaemia *Escherichia coli* of gulls Laridae around the Isle Helgoland (German Bight). Global Trends in Wildlife Management, 18th IUGB Congress, Krakow, Poland, August, 1987. Swait Press, Krakow. Pp. 273-275.

Verbeek, N. A. and C. Caffrey. 2002. American Crow (*Corvus brachyrhynchos*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/647.

VerCauteren, K.C., and D.R. Marks. 2004. Movements of urban Canada geese: implications for nicarbazin treatment programs. Pp. 151-156 *in* T. J. Moser, R. D. Lien, K. C. VerCauteren, K. F. Abraham, D. E. Anderson, J. G. Bruggink, J. M. Coluccy, D. A. Graber, J. O. Leafloor, D. R. Luukkonen, and R. E. Trost, editors. Proceedings of the 2003 International Canada Goose Symposium. Madison, Wisconsin.

Vermeer, K., D. Power, and G. E. J. Smith. 1988. Habitat selection and nesting biology of roof-nesting glaucous-winged gulls. Colonial Waterbirds 11:189–201.

Vogt, P.F. 1997. Control of nuisance birds by fogging with REJEX-IT TP-40. Proc. Great Plains Wildl. Damage Contr. Workshop 13. p. 63-66.

Walsh, J., V. Elia, R. Kane, and T. Halliwell. 1999. Birds of New Jersey. New Jersey Audubon Society, Bernardsville, New Jersey. 704 pp.

Weber, W.J. 1979. Health Hazards from Pigeons, European Starlings, and English Sparrows. Thompson Publ. Fresno, Calif. 138 pp.

Weeks, R. J., and A. R. Stickley. 1984. Histoplasmosis and its relation to bird roosts: a review. Denver Wildl. Res. Ctr. Bird Damage Rpt. No. 330. U.S. Fish and Wildl. Serv. 23pp.

Weseloh, D.V., and B. Collier. 1995. The rise of the Double-crested Cormorant on the Great Lakes : winning the war against contaminants. Great Lakes Fact Sheet. Canadian Wildlife Service, Environment Canada, Burlington, Ontario.

Weseloh, D.V., and P.J. Ewins. 1994. Characteristics of a rapidly increasing colony of double-crested cormorants (*Phalacrocorax auritus*) *in* Lake Ontario: population size, reproductive parameters, and band recoveries. Journal of Great Lakes Research 20:443–456.

Weseloh, D.V., P.J. Ewins, J. Struger, P. Mineau,C.A. Bishop, S. Postupalsky and J.P. Ludwig. 1995. Double- crested Cormorants of the Great Lakes: changes in population size, breeding distribution and reproductive output between 1913 and 1991. Colonial Waterbirds 18 (Special Publication):48-59.

West, R.R., and J.F. Besser. 1976. Selection of toxic poultry pellets from cattle rations by European Starlings. Proc. Bird Control Semin. 7:242-244.

West, R.R., J.F. Besser, and J.W. DeGrazio. 1967. Starling control in livestock feeding areas. Proc. Vertebr. Pest Conf. San Francisco, California.

Westberg, G.L. 1969. Comparative studies of the metabolism of 3-chloro-p-toluidine and 2-chloro-4-acetutoluidine in rats and chickens and methodology for the determination of 3-chloro-p-toluidine and metabolites in animal tissues. M.S. Thesis, University of California-Davis.

White, D.H., L.E. Hayes, and P.B. Bush. 1989. Case histories of wild birds killed intentionally with famphur in Georgia and West Virginia. Journal of Wild. Diseases. 25:144-188.

Whoriskey, F.G., and G.J. FitzGerald. 1985. Nest sites of the threespine stickleback: can site characteristics alone protect the nest against egg predators and are nests a limiting resource? Can. J. Zool. 63:1991–1994.

Wilbur, S. R. 1983. The status of vultures in the western hemisphere. Pages 113-123. *in* Vulture biology and management. Eds. By S.R. Wilbur and J.A. Jackson. University of California Press. Berkeley, California.

Willey, C.H., and B.F. Halla. 1972. Mute swans of Rhode Island. Rhode Island Department of Natural Resources. Div. of Fish and Wildlife. Pamphlet No. 8.

Williams, R.E. 1983. Integrated management of wintering blackbirds and their economic impact at south Texas feedlots. Ph.D. Dissertation, Tex. A&M Univ., College Station. 282 pp.

Williams, D. E., and R. M. Corrigan. 1994. Pigeons (rock doves). Pp. E87–E96 *in* S. E. Hygnstrom, R. E. Timm, and G. E. Larson, editors. Prevention and Control of Wildlife Damage. University of Nebraska, Lincoln, Nebraska. http://digitalcommons.unl.edu/icwdmhandbook/. Accessed May 9, 2013.

Winkler, D.W., K.K. Hallinger, D.R. Ardia, R.J. Robertson, B.J. Stutchbury, and R.R. Cohen. 2011. Tree Swallow (*Tachycineta bicolor*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/011.

Wires, L. R., and F. J. Cuthbert. 2001. Prioritization of waterbird colony sites for conservation in the U.S. Great Lakes. Final Report to USFWS. Available at: http://www.waterbirds.umn.edu/F2-CWBPrior.pdf .

Wires, L.R., F.J. Cuthbert, D.R. Trexel, and A.R. Joshi. 2001. Status of the double-crested cormorant (*Phalacrocorax auritus*) in North America. Report to the U.S. Fish and Wildlife Service, Arlington, Virginia.

Wobeser, G., and C.J. Brand. 1982. Chlamydiosis in 2 biologists investigating disease occurrences in wild waterfowl. Wildlife Society Bulletin 10170-172.

World Health Organization. 1998. Toxicological evaluation of certain veterinary drug residues in foods. World Health Organization, International Programme on Chemical Safety. http://www.inchem.org/documents/jecfa/jecmono/v041je10.htm. Accessed November 20, 2008.

Woronecki, P.P., R.A. Dolbeer, and T.W. Seamans. 1990. Use of alpha-chloralose to remove waterfowl from nuisance and damage situations. Proc. Vertbr. Pest Conf. 14:343-349.

Wright, E.N. 1973. Experiments to control starling damage at intensive animal husbandry units. Bull. OEPP. 9:85-89.

Yasukawa, K., and W. A. Searcy. 1995. Red-winged black bird (*Agelaius phoeniceus*) in A. Poole and F. Gill, editors. The Birds of North America Online. Cornell Lab of Ornithology, Ithaca, New York, USA. http://bna.birds.cornell.edu/bna/species/184.

Yoder, C.A., L.A. Miller, and K.S. Bynum. 2005. Comparison of nicarbazin absorption in chickens, mallards, and Canada geese. Poultry Science 84:1491–1494.

Zeranski, J.D. and T.R. Baptist. 1990. Connecticut Birds. University Press of New England, Hanover.

Zottoli, S.J. 1976. Fishing behavior of Common Grackles. Auk 93: 640–642.

APPENDIX B
BIRD DAMAGE MANAGEMENT METHODS AVAILABLE FOR USE OR RECOMMENDATION BY THE RHODE ISLAND WS' PROGRAM

NON-LETHAL METHODS - NONCHEMICAL

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

> **Cultural methods**. These may include altering planting dates so that crops are not young and more vulnerable to damage when the damage-causing species is present, or the planting of crops that are less attractive or less vulnerable to such species. At feedlots or dairies, cultural methods generally involve modifications to the level of care or attention given to livestock which may vary depending on the age and size of the livestock. Animal husbandry practices include but are not limited to techniques such as night feeding, indoor feeding, closed barns or corrals, removal of spilled grain or standing water, and use of bird proof feeders (Johnson and Glahn 1994).
>
> **Environmental/Habitat modification** can be an integral part of bird damage management. Wildlife production and/or presence are directly related to the type, quality, and quantity of suitable habitat. Therefore, habitat can be managed to reduce or eliminate the production or attraction of certain bird species or to repel certain birds. In most cases, the resource or property owner is responsible for implementing habitat modifications, and WS only provides advice on the type of modifications that have the best chance of achieving the desired effect. Habitat management is most often a primary component of bird damage management strategies at or near airports to reduce bird aircraft strike problems by eliminating bird nesting, roosting, loafing, or feeding sites. Generally, many bird problems on airport properties can be minimized through management of vegetation and water from areas adjacent to aircraft runways. Habitat management is often necessary to minimize damage caused by crows and blackbirds that form large roosts during late autumn and winter. Bird activity can be greatly reduced at roost sites by removing all the trees or selectively thinning the stand.

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

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

Paintball guns are used as a non-lethal harassment method to disperse birds from areas using physical harassment. Paintballs 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 a lowering of the aesthetic value of the neighborhood when used over personal gardens.

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

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

Lasers are a non-lethal technique recently evaluated by the NWRC (Glahn et al. 2000, 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 (see 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:

Bow nets Net are normally used for raptors but may also be used for European starlings, shorebirds, and other species using visual bait and/or conspecific decoys. Bow nets are remotely triggered from a nearby observation site.

Box/cage traps are used by WS for preventative and corrective damage management. Box/cage type traps are the same as traps used for mammals and use a visual attractant or bait in place of or in combination with an olfactory bait to attract target bird species.

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) or typical pigeon traps. Live decoy birds of the same species that are being targeted are usually placed in the trap with sufficient food and water to assure their survival. Perches are configured in the trap to allow birds to roost above the ground and in a more natural position. Feeding behavior and calls of the decoy birds attract other birds, which enter and become trapped themselves. Active decoy traps are monitored daily, every other day, or as appropriate if food, water, and shelter are provided, to remove and euthanize excess birds and to replenish bait and water. 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.

Drop nets are used by WS for preventative and corrective damage management. Drop traps are suspended over a pre-baited site and manually or remotely triggered to drop on target animals or is manually dropped on target birds from a high site such as a bridge or rooftop. Decoys may also be used to enhance the effectiveness of drop nets.

Foot-hold traps are used by WS for preventative and corrective damage management and could be used for live capture during disease monitoring. Trapping with foot-hold traps can be effective in areas where a small resident crow population is present (Johnson 1994). No. 0 or 1 foot-hold traps with padded jaws would be used to trap individual birds in areas habitually used by crows. Foothold traps could also be used to live capture gulls, double crested cormorants, raptors, and other bird species. Traps would be monitored a minimum of twice each day and trapped birds euthanized by methods approved by the AVMA or a veterinarian or 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).

Nest/walk-in traps are similar to box or decoy traps. They are placed over an active nest or baited with food and allow the target bird to pass through a funnel, one-way, or drop down door that confines the target. Nest and walk-in traps are effective in capturing ground nesting birds such as cormorants, ducks, geese, and gulls and ground feeding birds such as rock pigeons and mourning doves. They may be used by WS for corrective damage management and disease monitoring.

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 in to the United States in the 1950s from Asia and the Mediterranean where it was used to capture birds for the market (Day et al. 1980). The mist net is a fine black silk or nylon net usually 3 to 10 feet wide and 25 to 35 feet long. Net mesh size determines which birds can be caught and overlapping pockets in the net cause birds to entangle themselves when they fly into the net. Decoys and electronic calls may also be used to enhance the effectiveness of mist nets.

Net guns/launchers are normally used for flocking birds such as ducks, shorebirds, and European starlings. They use a firearm blank or compressed air to propel a weighted net up and over birds

which have been baited to a particular site or birds that do not avoid people. Net guns are manually discharged while net launchers are remotely discharged from a nearby observation site.

Raptor traps are varied in form and function and includes but is not limited to Bal-chatri, Dho Gaza traps, Phai hoop traps, pole traps, and Swedish goshawk traps. These traps are used specifically to trap raptors and several may be related to other live traps, for example pole traps utilize foothold traps attached to a pole or perch and Dho Gaza traps utilize mist nets.

Nest destruction is the removal of nesting materials during the construction phase of the nesting cycle. Nest destruction is generally only applied when dealing with a single bird or very few birds. This method is used to discourage birds from constructing nests in areas which may create nuisances for home and business owners. Heusmann and Bellville (1978) reported that nest removal was an effective but time-consuming method because problem bird species are highly mobile and can easily return to damage sites from long distances, or because of high populations. This method poses no imminent danger to pets or the public.

Egg addling/destruction is a method of suppressing reproduction in local nuisance bird populations by destroying egg embryos prior to hatching. Egg addling is conducted by vigorously shaking an egg numerous times which causes detachment of the embryo from the egg sac. Egg destruction can be accomplished in several different ways, but the most commonly used methods are manually gathering eggs and breaking them, or by oiling or spraying the eggs with a liquid which covers the entire egg and prevents the egg from obtaining oxygen (see *Egg oiling* below). Although WS does not commonly use egg addling or destruction, it is a valuable damage management tool and has proven effective in some applications.

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

NON-LETHAL METHODS - CHEMICAL

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

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

availability for intake by organisms from water, is non-accumulative in tissues and rapidly metabolized by many species (Schafer 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 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 Schafer, Jr. 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*b*). Cummings et al. (1995) found effectiveness of MA declined significantly after 7 days. Belant et al. (1996) found MA ineffective as a bird grazing repellent, even when applied at triple the recommended label rate. MA is also under investigation as a potential bird taste repellent. MA may become available for use as a livestock feed additive (Mason et al. 1984, Mason et al. 1989). It is registered for applications to turf or to surface water areas used by unwanted birds. The material has been shown to be nontoxic to bees (LD_{50} > 25 micrograms/bee[23]), nontoxic to rats in an inhalation study (LC_{50} > 2.8 mg/L[24]), and of relatively low toxicity to fish and other invertebrates. Methyl anthranilate is naturally occurring in concord grapes and in the blossoms of several species of flowers and is used as a food additive and perfume ingredient (Dolbeer et al. 1992). It has been listed as "*Generally Recognized as Safe*" by the FDA (Dolbeer et al. 1992).

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

Another potentially more cost effective method of MA application is by use of a fog-producing machine (Vogt 1997). The fog drifts over the area to be treated and is irritating to the birds while being non-irritating to any humans that might be exposed. Fogging applications must generally be repeated 3-5 times after the initial treatment before the birds abandon a treatment site. Applied at a rate of about 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

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[23] 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.

[24] 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.

endangered species. Dimmick and Nicolaus (1990) showed breeding pairs of crows could be conditioned with aversive chemicals to avoid eggs. However, Avery and Decker (1994) observed increased consumption of eggs treated with higher doses of Mesurol by Fish Crows. Sullivan and Dinsmore (1990) reported bird nests greater than 700 meters from crow nests were relatively safe from crow predation, thus nests beyond 700 meters from active crow nests may not need to be treated.

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

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

Other chemical repellents. A number of other chemicals have shown bird repellent capabilities. Anthraquinone, a naturally occurring chemical found in many plant species and in some invertebrates as a natural predator defense mechanism, has shown effectiveness in protecting rice seed from red-winged blackbirds and boat-tailed grackles (Avery et al. 1997). It has also shown effectiveness as a foraging repellent against Canada goose grazing on turf and as a seed repellent against brown-headed cowbirds (Dolbeer et al. 1998).

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. 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 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.

Canada geese have been successfully vasectomized to prevent production of young; this method is only effective if the female does not form a bond with a different male. In addition, vasectomies can only prevent the production of the mated pair. The ability to identify breeding pairs for isolation and to capture a male bird for vasectomizing becomes increasingly difficult as the number of birds increase (Converse and Kennelly 1994). Keefe (1996) estimated mechanical sterilization of a Canada goose to cost over $100 per bird.

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

Nicarbazin is thought to induce infertility in birds by two main mechanisms. Nicarbazin may disrupt the membrane surrounding the egg yolk, resulting in intermixing of egg yolk and white (albumin) components, creating conditions in which the embryo cannot develop. Nicarbazin may also inhibit incorporation of cholesterol into the yolk, a step that is necessary for yolk formation, thereby limiting energy for the developing embryo. If the yolk does not provide enough energy, the embryo will not completely form and the egg will never hatch. Nicarbazin bait must be consumed for several days to achieve blood levels that affect the hatchability of eggs that are forming. Nicarbazin is undetectable in the plasma of Canada Geese, Mallards, and chickens by 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% ($P < 0.001$). The high degree of variability among Canada Geese in their movement patterns, nesting and habitat use complicates use of this product (Vercauteren and Marks 2004). The variability in goose behavior can make it difficult to get the required doses to the geese (see below). Under current label guidelines, the cost for nicarbazin (Ovocontrol®)

applications exceeds the cost of other control methods (Cooper and Keefe 1997) until the goose 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 RIDEM 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 woodpeckers, and other cavity using birds. They are very selective because they are usually set in the defended territory of the target birds. The trap treadle is usually left un-baited, reducing attraction to non-target avian species, and attached near the damage area and the offending bird lands on the trap due to curiosity or availability of a new perch. 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. If un-baited traps are ineffective, they may be baited with peanut butter, suet, or other food attractants.

LETHAL METHODS - CHEMICAL

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

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

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

DRC-1339 is a slow acting avicide that is registered with the EPA for reducing damage from several species of birds, including blackbirds, starlings, pigeons, crows, ravens, magpies, and gulls. DRC-1339 was developed as an avicide because of its differential toxicity to mammals. DRC-1339 is highly toxic to sensitive species but only slightly toxic to non-sensitive birds, predatory birds, and mammals (Schafer 1981, Schafer 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. 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.

DRC-1339 has several EPA Registration Labels (56228-10, 56228-28, and 56228-30) depending on the application or species involved in the bird damage management project. Rhode Island WS has not used

or supervised the use of DRC-1339 from FY 2006 through FY 2012. DRC-1339 is not currently registered for use in Rhode Island.

APPENDIX C
FEDERALLY AND STATE LISTED THREATENED AND ENDANGERED SPECIES IN THE STATE OF RHODE ISLAND

RARE NATIVE ANIMALS OF RHODE ISLAND
Revised: March, 2006

ABOUT THIS LIST

The list is divided by vertebrates and invertebrates and is arranged taxonomically according to the recognized authority cited before each group. Appropriate synonymy is included where names have changed since publication of the cited authority.

The Natural Heritage Program's *Rare Native Plants of Rhode Island* includes an estimate of the number of "extant populations" for each listed plant species, a figure which has been helpful in assessing the health of each species. Because animals are mobile, some exhibiting annual long-distance migrations, it is not possible to derive a population index that can be applied to all animal groups. The status assigned to each species (see definitions below) provides some indication of its range, relative abundance, and vulnerability to decline. More specific and pertinent data is available from the Natural Heritage Program, the Rhode Island Endangered Species Program, and the Rhode Island Natural History Survey.

STATUS The status of each species is designated by letter codes as defined:

(FE) **Federally Endangered:** 5 species listed, 3 currently occur in State-roseate tern, American burying beetle, and sandplain gerardia (USFWS 2008)

(FT) **Federally Threatened:** 3 species listed, 2 currently occur in State- piping plover and small whorled pogonia (USFWS 2008)

(SE) **State Endangered:** Native species in imminent danger of extirpation from Rhode Island. These taxa may meet one or more of the following criteria:

1. Formerly considered by the U.S. Fish and Wildlife Service for Federal listing as endangered or threatened.
2. Known from an estimated 1 to 2 total populations in the state.
3. Apparently globally rare or threatened; estimated at 100 or fewer populations range-wide.

Animals listed as State Endangered are protected under the provisions of the Rhode Island State Endangered Species Act, Title 20 of the General Laws of the State of Rhode Island. This law states, in part (20-37-3):

"No person shall buy, sell, offer for sale, store, transport, export, or otherwise traffic in any animal or plant or any part of any animal or plant whether living or dead, processed, manufactured, preserved or raw if such animal or plant has been declared to be an endangered species by either the United States secretaries of the Interior or Commerce or the Director of the R. I. Department of Environmental Management."

(ST) **State Threatened:** Native species that are likely to become State Endangered in the future if current trends in habitat loss or other detrimental factors remain unchanged. In general, these taxa have 3-5 known or estimated populations and are especially vulnerable to habitat loss.

(C) Concern: Native species not considered to be State Endangered or State Threatened at the present time, but are listed due to various factors of rarity and/or vulnerability. Species listed in this category may warrant endangered or threatened designation, but status information is presently not well known.

(SH) State Historical: Native species which have been documented for the state during the last 100 years, but which are currently unknown to occur. When known, the year of the last documented occurrence in Rhode Island is included.

FUTURE REVISIONS

The listing of rare species is an ongoing process requiring annual revisions to reflect the best scientific information available concerning the circumstances of rarity, as well as our increased knowledge of the native fauna. Submission of additional data on species currently listed, or on other species which may warrant listing, is encouraged.

Information may be sent to:

Rhode Island Natural Heritage Program
Rhode Island Dept. of Environmental Management
Division of Planning & Development
235 Promenade Street
Providence, Rhode Island 02908
Telephone: (401) 222-2776 ext.4308

Rhode Island Endangered Species Program
Rhode Island Dept. of Environmental Management
Division of Fish and Wildlife
Great Swamp Management Area
West Kingston, Rhode Island 02892
Telephone: (401) 789-0281

INVERTEBRATES

The task of evaluating the status of invertebrates in Rhode Island has been initiated for several selected groups. At this time the list primarily includes freshwater bivalves (clams and mussels) and the following insect groups: lepidopterans (moths and butterflies), odonates (dragonflies and damselflies), silphids (burying beetles), and cicindelids (tiger beetles). Additional taxa will be added in the future upon the completion of further research and inventory. The following publications are a partial listing of taxonomic references:

Boyd, H.P. and Associates. 1982. *Checklist of Cicindelidae: The Tiger Beetles*. Plexus Publishing, Marlton, New Jersey. 1-31.

Hodges, R.W., et. al. 1983. *Check list of the Lepidoptera of America north of Mexico*. E.W. Classey Ltd. and Wedge Entomological Research Foundation. 1-284.

Johnson, R.I. 1980. *Zoogeography of North American Unionacea (Mollusca: Bivalvia) north of the maximum Pleistocene glaciation*. Bull. Museum Comparative Zoology. 149:77-189.

Paulson, D.R. and S.W. Dunkle. 1999. *A checklist of North American Odonata, including English name, etymology, type locality, and distribution*. Slat. Mus. Nat. Hist. Occ. Pap. 56.

BIVALVE MOLLUSKS

Unionoida (freshwater mussels)		
Margaritiferidae (pearlshells)		
Margaritifera margaritifera	Eastern Pearlshell	SE
Unionidae (unionid mussels)		
Alismidonta varicosa	Brook Floater	SH (1897)
Lampsilis radiata	Lampmussel	C
Ligumia nasuta	Eastern Pond Mussel	C

Strophitus undulatus	Squawfoot	C
CRUSTACEANS		
Amphipoda (amphipods)		
Crangonyctidae (freshwater amphipods)		
Synurella chamberlaini	Coastal Swamp Amphipod	C
INSECTS		
Coleoptera (beetles)		
Cicindelidae (tiger beetles)		
Cicindela dorsalis dorsalis	Northeastern Beach Tiger Beetle	FT/SH (1978)
Cicindela formosa generosa	Pine Barrens Tiger Beetle	ST
Cicindela hirticollis	Seabeach Tiger Beetle	ST
Cicindela limbalis	Claybanks Tiger Beetle	C
Cicindela marginata	Salt Marsh Tiger Beetle	ST
Cicindela patruela	Barrens Tiger Beetle	SH (1921)
Cicindela purpurea	Purple Tiger Beetle	C
Cicindela rufiventris	Red-bellied Tiger Beetle	C
Cicindela tranquebarica	Dark-bellied Tiger Beetle	ST
Silphidae (burying beetles)		
Nicrophorus americanus	American Burying Beetle	FE
Staphylinidae (rove beetles)		
Lordithon niger	Black Lordithon Rove Beetle	C
Lepidoptera (butterflies and moths)		
Lycaenidae (coppers, hairstreaks, elfins, & blues)		
Lycaena epixanthe	Bog Copper	C
Satyrium acadica	Acadian Hairstreak	C
Satyrium caryaevorum	Hickory Hairstreak	C
Mitoura hesseli	Hessel's Hairstreak	C
Incisalia henrici	Henry's Elfin	C
Incisalia irus	Frosted Elfin	ST
Incisalia polia	Hoary Elfin	C
Fixsenia favonius ontario	Northern Hairstreak	C
Parrhasius m-album	White M Hairstreak	C
Nymphalidae (brush-footed butterflies)		
Speyeria idalia	Regal Fritillary	SH (1990)
Boloria bellona	Meadow Fritillary	C
Enodia anthedon	Northern Pearly Eye	C
Hesperiidae (skippers)		
Erynnis brizo	Sleepy Duskywing	C
Erynnis persius	Persius Duskywing	SH (1950)
Poanes massasoit	Mulberry Wing	C
Poanes viator zizaniae	Broad Winged Skipper	C
Atrytonopsis hianna	Dusted Skipper	C
Noctuidae (noctuid moths)		
Abagrotis crumbi benjamini	Benjamin's Abagrotis	C
Acronicta lanceolaria	A Noctuid Moth	C
Apharetra purpurea	Blueberry Sallow	C
Aplectoides condita	A Noctuid Moth	C
Grammia speciosa	An Arctiid Moth	C
Lithophane viridipallens	Pale Green Pinion Moth	C

Metarranthis pilosaria	Coastal Swamp Metarranthis	C
Papaipema appassionata	Pitcher Plant Borer	C
Papaipema leucostigma	Columbine Borer	SH
Spartiniphaga inops	Spartina Borer	C
Zale sp. (*)	Pine Barrens Zale	C
Zale submediana	A Noctuid Moth	C

(*) a full scientific name for this species has not been published.

Saturniidae (saturnid moths)		
Citheronia regalis	Royal Walnut Moth	SH (1939)
Citheronia sepulcralis	Pine Devil	SH
Hemileuca maia maia	Barrens Buckmoth	C
Odonata (dragonflies and damselflies)		
Coenagrionidae (pond damselflies)		
Enallagma pictum	Scarlet Bluet	C
Enallagma recurvatum	Pine Barrens Bluet	C
Lestes unguiculatus	Lyre-tipped Spreadwing	C
Nehalennia integricollis	Southern Sprite	ST
Gomphidae (clubtails)		
Ophiogomphus aspersus	Brook Snaketail	ST
Progomphus obscurus	Common Sanddragon	C
Stylurus scudderi	Zebra Clubtail	ST
Stylurus spiniceris	Arrow Clubtail	C
Aeshnidae (darners)		
Aeshna mutata	Spatterdock Darner	C
Anax longipes	Comet Darner	C
Corduliidae (emeralds)		
Cordulegaster obliqua	Arrowhead Spiketail	C
Neurocordulia obsoleta	Umber Shadowdragon	C
Somatochlora georgiana	Coppery Emerald	C
Williamsonia lintneri	Ringed Boghaunter	SE
Libellulidae (common skimmers)		
Leucorrhinia glacialis	Crimson-ringed Whiteface	ST
Libellula auripennis	Golden-winged Skimmer	C

FISH

Petromyzontidae (lampreys)		
Lampetra appendix	American Brook Lamprey	ST
Acipenseridae (sturgeons)		
Acipenser oxyrhynchus	Atlantic Sturgeon	SH
Acipenser brevirostrum	Shortnose Sturgeon	FE (SH)

AMPHIBIANS

Plethodontidae (lungless salamanders)		
Gyrinophilus porphyriticus	Northern Spring Salamander	C
Pelobatidae (spadefoot toads)		
Scaphiopus holbrookii	Eastern Spadefoot	SE
Ranidae (true frogs)		
Rana pipiens	Northern Leopard Frog	C

REPTILES

Cheloniidae (sea turtles) - offshore waters only.		
Caretta caretta	Loggerhead Sea Turtle	FT
Eretmochelys imbricata	Hawksbill Sea Turtle	FE
Lepidochelys kempii	Kemp's Ridley Sea Turtle	FE
Dermochelyidae (leatherback turtles) - offshore waters only.		
Dermochelys c. coriacea	Atlantic Leatherback	FE
Emydidae (turtles)		
Clemmys guttata	Spotted Turtle	P
Clemmys insculpta	Wood Turtle	C/P
Malaclemys t. terrapin	Northern Diamondback Terrapin	SE/P
Terrapene carolina	Eastern Box Turtle	P
Colubridae (colubrid snakes)		
Carphophis amoenus	Eastern Worm Snake	C
Elaphe obsoleta	Black Rat Snake	C
Heterodon platirhinos	Eastern Hognose Snake	C
Thamnophis sauritus	Eastern Ribbon Snake	C
Viperidae (vipers)		
Crotalus horridus	Timber Rattlesnake	SH(1972)/ P

BIRDS

Podicipedidae (grebes)		
Podilymbus podiceps	Pied-billed Grebe	SE
Ardeidae (herons)		
Botaurus lentiginosus	American Bittern	SE
Ixobrychus exilis	Least Bittern	ST
Ardea herodias	Great Blue Heron	C
Ardea albus	Great Egret	C
Egretta caerulea	Little Blue Heron	C
Egretta thula	Snowy Egret	C
Bubulcus ibis	Cattle Egret	C
Nycticorax nycticorax	Black-crowned Night Heron	C
Nyctanassa violacea	Yellow-crowned Night Heron	C
Threskiornithidae (ibises)		
Plegadis falcinellus	Glossy Ibis	C
Anatidae (swans, geese, ducks)		
Anas crecca	Green-winged Teal	C
Anas discors	Blue-winged Teal	C
Anas strepera	Gadwall	C
Lophodytes cucullatus	Hooded Merganser	C
Accipitridae (eagles, hawks)		
Haliaeetus leucocephalus	Bald Eagle	FT*
Pandion haliaetus	Osprey	C
Circus cyaneus	Northern Harrier	SE
Accipiter striatus	Sharp-shinned Hawk	SH (1939)
Accipiter cooperii	Cooper's Hawk	C
Accipiter gentilis	Northern Goshawk	C
Falco peregrinus	Peregrine Falcon	SE
Rallidae (rails, gallinules)		
Rallus elegans	King Rail	C
Rallus longirostris	Clapper Rail	C

Porzana carolina	Sora	C
Gallinula chloropus	Common Moorhen	SH (1970)
Charadriidae (plovers)		
Charadrius melodus	Piping Plover	FT
Haematopodidae (oystercatchers)		
Haematopus palliatus	American Oystercatcher	C
Scolopacidae (sandpipers)		
Catoptrophorus semipalmatus	Willet	C
Bartramia longicauda	Upland Sandpiper	SE
Laridae (gulls, terns)		
Sterna dougallii	Roseate Tern	FE/SH (1979)
Sterna antillarum	Least Tern	ST
Tytonidae (barn owls)		
Tyto alba	Barn Owl	SE
Strigidae (owls)		
Asio otus	Long-eared Owl	C
Aegolius acadicus	Northern Saw-whet Owl	C
Caprimulgidae (goatsuckers)		
Chordeiles minor	Common Nighthawk	C
Picidae (woodpeckers)		
Dryocopus pileatus	Pileated Woodpecker	C
Tyrannidae (flycatchers)		
Empidonax virescens	Acadian Flycatcher	C
Alaudidae (larks)		
Eremophila alpestris	Horned Lark	C
Hirundinidae (swallows)		
Hirundo pyrrhonota	Cliff Swallow	SH (1991)
Troglodytidae (wrens)		
Troglodytes troglodytes	Winter Wren	C
Cistothorus palustris	Marsh Wren	C
Parulidae (warblers)		
Vermivora chrysoptera	Golden-winged Warbler	SH (1960)
Parula americana	Northern Parula	ST
Dendroica caerulescens	Black-throated Blue Warbler	ST
Dendroica cerulea	Cerulean Warbler	SE
Dendroica fusca	Blackburnian Warbler	ST
Protonotaria citrea	Prothonotary Warbler	C
Helmitheros vermivorus	Worm-eating Warbler	C
Icteria virens	Yellow-breasted Chat	SE
Emberizidae (sparrows)		
Pooecetes gramineus	Vesper Sparrow	SH (1984)
Ammodramus henslowii	Henslow's Sparrow	SH (1940)
Ammodramus savannarum	Grasshopper Sparrow	ST
Ammodramus maritimus	Seaside Sparrow	C
Zonotrichia albicollis	White-throated Sparrow	C
Junco hyemalis	Dark-eyed Junco	C

*Bald Eagles have been removed from the federal endangered species list

MAMMALS

Soricidae (shrews)		
Sorex fumeus	Smoky Shrew	C

Sorex palustris	Water Shrew	C
Leporidae (rabbits, hares)		
Sylvilagus transitionalis	New England Cottontail	C
Muridae (mice)		
Synaptomys cooperi	Southern Bog Lemming	C
Felidae (cats)		
Lynx rufus	Bobcat	ST
Balaenopteridae (rorquals)		
Balaenoptera physalus	Fin Whale	FE
Megaptera novaeangliae	Humpback Whale	FE
Balaenidae (right whales)		
Eubalaena glacialis	North Atlantic Right Whale	FE

APPENDIX D
USFWS NEFO "*NO SPECIES PRESENT*" LETTER

United States Department of the Interior

FISH AND WILDLIFE SERVICE

New England Field Office
70 Commercial Street, Suite 300
Concord, NH 03301-5087
http://www.fws.gov/newengland

January 17, 2012

To Whom It May Concern:

This project was reviewed for the presence of federally listed or proposed, threatened or endangered species or critical habitat per instructions provided on the U.S. Fish and Wildlife Service's New England Field Office website:

(http://www.fws.gov/newengland/EndangeredSpec-Consultation.htm)

Based on information currently available to us, no federally listed or proposed, threatened or endangered species or critical habitat under the jurisdiction of the U.S. Fish and Wildlife Service are known to occur in the project area(s). Preparation of a Biological Assessment or further consultation with us under section 7 of the Endangered Species Act is not required. No further Endangered Species Act coordination is necessary for a period of one year from the date of this letter, unless additional information on listed or proposed species becomes available.

Thank you for your cooperation. Please contact Mr. Anthony Tur of this office at 603-223-2541 if we can be of further assistance.

Sincerely yours,

Thomas R. Chapman
Supervisor
New England Field Office