ENVIRONMENTAL ASSESSMENT

REDUCING THE EFFECTS OF PREDATION ON THREATENED AND ENDANGERED BIRDS IN THE STATE OF MAINE

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In Cooperation With:

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

United States Department of the Interior
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TABLE OF CONTENTS

ACRONYMS

AMDUCA	Animal Medicinal Drug Use Clarification Act
APHIS	Animal and Plant Health Inspection Service
AVMA	American Veterinary Medical Association
BBS	Breeding Bird Survey
BCR	Bird Conservation Region
BO	Biological Opinion
CBC	Christmas Bird Count
CCP	Comprehensive Conservation Plan
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
EA	Environmental Assessment
ECOFRAM	Ecological Committee on FIFRA Risk Assessment
EIS	Environmental Impact Statement
EPA	United States Environmental Protection Agency
ESA	Endangered Species Act
FDA	Food and Drug Administration
FEIS	Federal Environmental Impact Statement
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FONSI	Finding of No Significant Impact
FR	Federal Register
FY	Fiscal Year
IC	Intracardiac
IV	Intravenous
IWDM	Integrated Wildlife Damage Management
MANEM	Mid-Atlantic/New England/Maritime
MBTA	Migratory Bird Treaty Act
MCINWR	Maine Coastal Islands National Wildlife Refuge
MDABPC	Maine Department of Agriculture Board of Pesticides Control
MDIFW	Maine Department of Inland Fisheries and Wildlife
MOU	Memorandum of Understanding
MRS	Maine Revised Statutes
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NWRC	National Wildlife Research Center
PBR	Potential Biological Removal
PL	Public Law
RCNWR	Rachel Carson National Wildlife Refuge
SOP	Standard Operating Procedure
T&E	Threatened and Endangered
USC	United States Code
USDA	United States Department of Agriculture
USDI	United States Department of Interior
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
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 the State of Maine continues to receive requests for assistance to resolve or prevent predation on nesting native bird populations on coastal islands and beaches associated with red fox (*Vulpes vulpes*), gray fox (*Urocyon cinereoargenteus*), coyotes (*Canis latrans*), raccoons (*Procyon lotor*), Virginia opossum (*Didelphis virginiana*), striped skunks (*Mephitis mephitis*), mink (*Mustela vison*), long-tailed weasels (*Mustela frenata*), short-tailed weasels (*Mustela erminea*), feral and domestic cats (*Felis* spp.), feral and domestic dogs (*Canis* spp.), eastern chipmunks (*Tamias striatus*), ring-billed gulls (*Larus delawarensis*), herring gulls (*Larus argentatus*), great black-backed gulls (*Larus marinus*), laughing gulls (*Larus atricilla*), American crows (*Corvus brachyrhynchos*), American kestrels (*Falco sparverius*), merlins (*Falco columbarius*), and great horned owls (*Bubo virginianus*). Collectively, those species of wildlife are known to feed on eggs, adults, and nestlings of ground nesting bird species, including threatened and endangered (T&E) bird species, and will be referred to collectively as nest predators[2] throughout the EA. Normally, individual wildlife damage management actions conducted by the WS program could be categorically excluded from further analysis under the National Environmental Policy Act (NEPA), in accordance with APHIS implementing regulations for the NEPA (7 CFR 372.5(c), 60 FR 6000-6003).

The purpose of this Environmental Assessment (EA) is to evaluate activities conducted by WS to manage predation and the threat of predation on federal and state-listed T&E species. This EA will also evaluate the issuance of depredation permits by the Migratory Bird Division of the United States Fish and Wildlife Service (USFWS) for the take of protected bird species pursuant to the Migratory Bird Treaty Act (MBTA). In addition, this EA will facilitate planning between WS, the USFWS, and the Maine Department of Inland Fisheries and Wildlife (MDIFW) to initiate funding mechanisms under grant programs administered by the Wildlife and Sport Fish Program for the conservation of T&E species. Other federal funding mechanisms through the USFWS, including Endangered Species Act (ESA) recovery implementation funds or refuge project funds may also be evaluated and utilized to reduce the risk of predation.

The development of this EA by WS and the cooperating agencies will assist in determining if the proposed management of predation on nesting bird populations along the coastal islands and coastal areas of the State could have a significant impact on the environment for both humans and other organisms. The EA will also assist with identifying and addressing issues associated with managing predation risks. In addition, the EA will analyze alternative approaches to address those issues. This EA will also be a planning document to coordinate efforts with other federal, State, and local agencies. The public involvement process associated with the development of the EA will inform the public of the proposed activities and will allow for public input into the process. This EA analyzes the potential effects of managing predation risks when requested, as coordinated between WS, the USFWS, and the MDIFW.

WS, along with the cooperating agencies, are preparing this EA to: 1) facilitate planning, 2) promote interagency coordination, 3) streamline program management, 4) clearly communicate to the public the analysis of individual and cumulative impacts of program activities; and 5) evaluate and determine if there are any potentially significant or cumulative effects from the proposed program. The analyses

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

[2]Although collectively referred to as "*nest*" predators, those mammalian and avian species are known to feed on the eggs, nestlings, and adults of ground nesting birds and are not restricted to destroying just the nests of ground nesting birds. Furthermore, the presence of these predators at nesting sites frequently causes adult birds to abandon their nest and eggs, or entire colonies to abandon nesting areas.

contained in this EA are based on information derived from WS' Management Information System, published documents (see Appendix A), interagency consultations, and public involvement.

The EA evaluates the need for action to manage predation risks associated with nest predators, the potential issues associated with managing predation or threats of predation on nesting bird populations, and the environmental consequences of conducting different alternatives to meet the need for action and address the identified issues. The issues and alternatives associated with managing predation risks were initially developed by WS in cooperation with the USFWS, and in consultation with the MDIFW. The MDIFW has regulatory authority to manage populations of bird and mammal species in the State while the management of native migratory bird populations is the overall responsibility of the USFWS. In addition, issues and alternatives were also identified during a public scoping meeting prior to the development of the EA. To assist with the identification of additional issues and alternatives to managing nest predation associated with predators in Maine, this EA will be made available to the public for review and comment prior to a Decision[3].

This EA evaluates activities based on similar activities conducted previously by WS and the cooperating agencies that have been evaluated under separate analyses in accordance with the NEPA. This EA also addresses the potential effects of managing nest predation by predators in areas where additional requests for assistance may be received in the future or where nesting may occur in the future. Because the missions of the cooperating agencies are to conduct a coordinated program in accordance with plans, goals, and objectives developed to reduce predation associated with wildlife, and because the goals and directives are to provide services when requested, within the constraints of available funding and workforce, it is conceivable that additional management efforts could occur. Thus, this EA anticipates those additional efforts and the analyses are intended to apply to actions that may occur in any locale and at any time along the coastal areas of Maine as part of a coordinated program.

1.2 NEED FOR ACTION

Wildlife management in modern environments has to contend with the inheritance of faunal and landscape changes caused by humans, which can affect the relationships between predators and prey (Reynolds and Tapper 1996). Avian and mammalian predators prey on a variety of natural resources, including T&E species. Native predators would normally be considered part of the function of a healthy ecosystem. Many of the nest predators addressed in this EA are native to Maine; however, many changes have occurred in the coastal ecosystem of Maine that has disrupted natural predator-prey relationships. Many of the changes that have occurred can be attributed to human influence, including habitat fragmentation, landscape alteration, and environmental contamination. In addition, human habitation alone alters the biological carrying capacity of the coastal environment. Some species such as raccoons and skunks live in high densities because of human activity. Those human-induced changes can negatively affect the viability of some native bird populations that ground nest in coastal areas.

Native birds that historically nested on islands evolved in an environment free or mostly free of mammalian predators (Wittenberger and Hunt 1985, Kharitonov and Siegel-Causey 1988, Rolland et al. 1998). The reproductive failure of colonial waterbirds due to range expansion or introduction of non-native or native predatory mammals is a growing management concern for conservation biologists (Nettleship et al. 1994, Cote and Sutherland 1997, Erwin et al. 2001). Mammalian predators on islands often lead to the complete failure of bird colonies to fledge young (Craik 1997, Viksne 1997) or have lead

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

to declines in the number of chicks fledged (Clode and MacDonald 2002). Similarly, fragmented mainland habitat that occurs in close proximity to human development is also subject to unnatural levels of predation because nesting birds tend to be concentrated by human development and recreational activities in the coastal environment. Predators are able to key in on these concentrations of nesting birds and can have devastating results on nesting productivity. For example, Small and Hunter (1988) documented greater nest predation in small tracts of land in Maine.

Some changes to the coastal ecosystem in Maine are the result of natural ecological actions. Those actions include beach alterations that occur from extreme tide, wind, and rain during storm events. A growing body of literature also supports the climate is changing in numerous ways, and that sea levels are predicted to rise dramatically during the next century (Leatherman et al. 1995, Galbraith et al. 2002, Intergovernmental Panel on Climate Change 2007). The overall effect of those changes to waterbird nesting habitat is not well understood; however, it is conceivable that some habitats could be further degraded, while some new habitat could be created from the over wash of higher elevated areas.

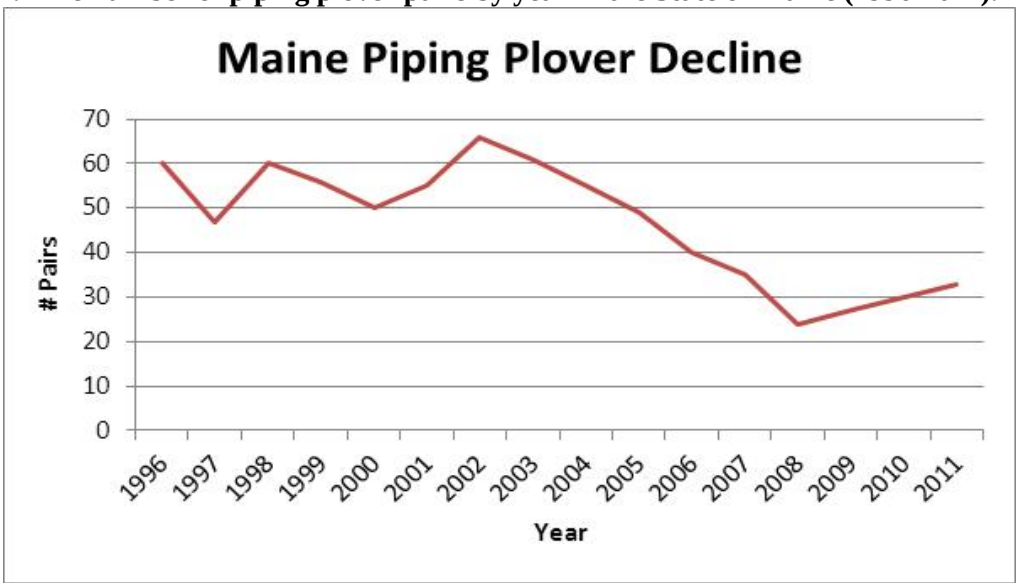
Alteration of the Predator – Prey Relationships from Human Disturbances

Faunal communities in Maine have changed over the last 400 years. Those changes were primarily brought about by people. The European red fox was introduced by colonists from Europe during the colonization of North America (Paradiso 1969, Samuel and Nelson 1982, Linzey 1998, Kamler and Ballard 2002). Eastern timber wolves (*Canis lupus*) were well established in New England during the time of colonial settlement in the 1600s (Godin 1977). By the early 1900s wolves were rare in Maine due to exploitation by humans, and were believed to be extirpated soon thereafter (Nowak 2002). Wolves would have preyed upon raccoons and presumably prohibited the colonization of coyotes and red fox. Additionally, eastern cougars (*Puma concolor couguar*) were known to occupy New England until 1938 (Godin 1977). The loss of cougars and wolves as top-level carnivores from the eastern forest has caused a cascade of trophic effects caused by the eruption of deer populations and subsequent effects on vegetation and animal communities (Leopold 1943, Ripple and Beschta 2006, Ripple and Beschta 2008), and has been termed "*ecological meltdown*" (Terborgh et al. 2001). An increase in raccoons, fox, skunks, and other mid-sized predators in the absence of a dominant carnivore is a phenomenon known as mesopredator release (Soule et al. 1988). Fragmentation of the environment, stable food sources associated with modern agriculture, and other stable food resources (*e.g.*, landfills, dumpsters) led to increases in the survival of juvenile gulls and subsequent population growth and expansion (Drury 1973, Erwin 1979*a*, Erwin 1979*b*). A combination of expanding human populations, along with the introduction of non-native species brought new predation pressure on shorebirds and seabirds nesting in the Gulf of Maine.

Need for Predator Management to Protect Piping Plovers

Piping plovers are state-endangered, federally threatened, shorebirds that breed on sandy beach habitats. There are less than 2,000 pairs of Atlantic Coast piping plovers in existence today (USFWS 2011*a*). In Maine, the number of piping plover pairs observed have declined over 65% since 2002 (see Figure 1-1), which is likely due to an average productivity of 1.18 fledglings per pair from 2002 through 2007. Consequently, the number of nesting pairs in Maine has declined from a high of 65 pairs in 2002 to approximately 24 pairs in 2008; the lowest level in more than 15 years. Recent findings indicate that the productivity needed to maintain a stable piping plover population in New England is 1.21 fledglings per pair but this rate varies with latitude (Hecht and Melvin 2009). The location of Maine in northern New England makes it likely that greater than 1.25 fledged chicks/pair is needed for a stable population, with a correspondingly higher goal for a secure population. The productivity goal of 1.5 fledglings per pair is identified in the Piping Plover Recovery Plan developed by the USFWS (USFWS 1996) and is the minimum goal within the Wildlife Conservation Strategy developed by the MDIFW (MDIFW 2005).

Figure 1-1. The number of piping plover pairs by year in the State of Maine (1996-2011).



Need for Predator Management to Protect Least Terns

Least terns are state-endangered waterbirds and are listed as a high priority for conservation within Bird Conservation Region (BCR) 30 (Steinkamp 2008), which includes the extreme southwestern corner of the State. Least tern colonies have suffered intense nest and chick predation in recent years (USFWS, unpublished data). In 2005, predation forced abandonment of traditional mainland nesting grounds in Maine with a portion of the tern colony relocating to Stratton Island off the coast in southwestern Maine, where sandy beach habitat is limited and disease transmission and competition from the thousands of common terns is of concern. In 2007, least tern pairs that did not nest on Stratton Island (approximately 30% of the State population) moved from colony site to colony site as predators decimated virtually all nesting attempts (Felio et al. 2008). Mainland pair productivity was 0.11 fledglings per pair while overall productivity was 0.75 for the State, both well below the goal of 1.0 fledgling per pair established by the MDIFW. The last time productivity was at or above the State goal was in 2001 (Maine Audubon, unpublished data).

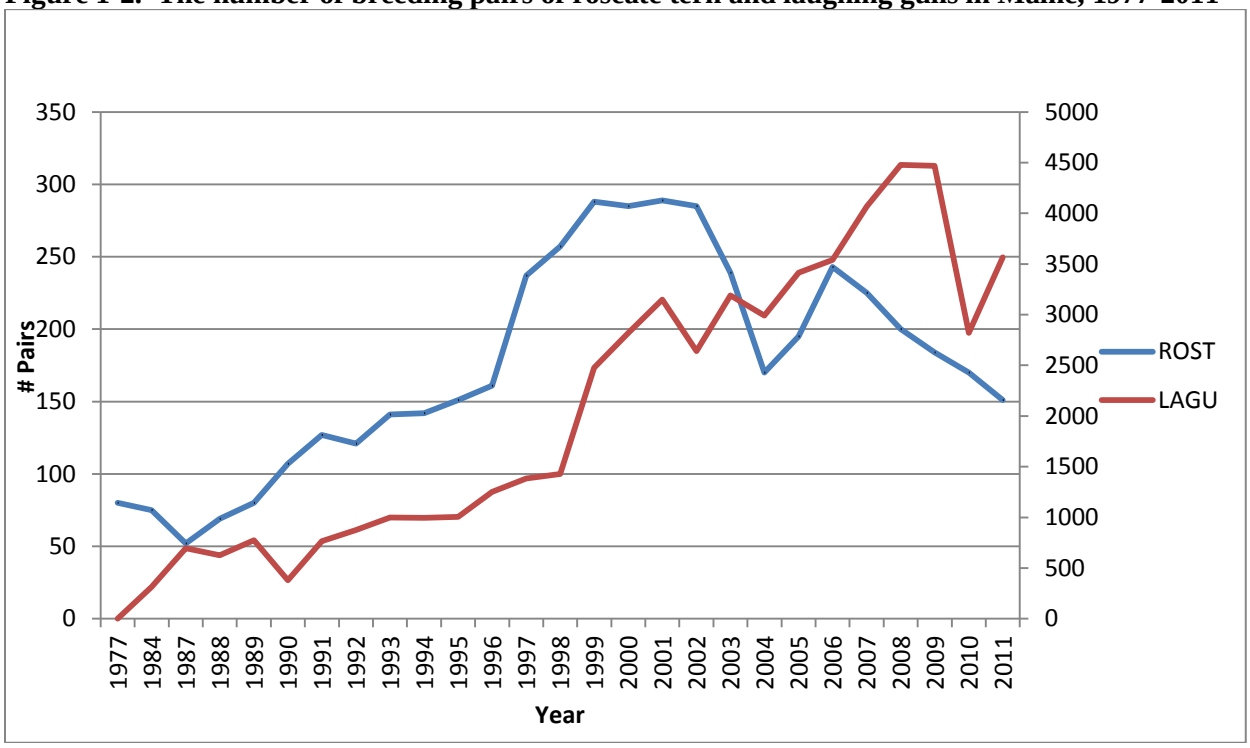
Need for Predator Management to Protect Roseate Terns

Roseate terns are another federally endangered species that has undergone strict monitoring and restoration efforts over the past two decades. Historically, the numbers of roseate terns nesting in the Northeast United States were greatly reduced (as were most seabirds) by commercial hunting for the millinery trade in the late 19th century (Drury 1973). The population recovered with protection under the MBTA, increasing to about 8,500 pairs in the 1930s (USFWS 1998). However, gull populations also increased from protection under the MBTA (Kadlec and Drury 1968) as well as from anthropomorphic features, such as landfills. The expanding gull populations subsequently caused the tern population to decline resulting from gull competition and predation (Hatch 1970, Becker 1995, Kress and Hall 2002). The roseate tern population had declined to about 4,800 pairs in 1952, and decreased further to a low of about 2,500 pairs in 1977 (USFWS 1998). The estimated total breeding population has fluctuated in the range of about 2,750 to 3,425 pairs since 1988, but the number of sites at which most birds nest remains critically low (USFWS 1998). In 1978, about 90% of the roseate terns in North America nested in four large colonies; in 1988, about 86% nested on only two small islands; one in Buzzards Bay, Massachusetts and the other off the eastern tip of Long Island, New York (USFWS 1998).

As of 1997, the loss of breeding birds at sites on western Long Island, New York and around Cape Cod, Massachusetts have been more than offset by an increase in the numbers of birds nesting in Buzzards Bay, at Great Gull Island in New York, and in the northern Gulf of Maine in the United States. However, at that time, approximately 85% of roseate terns were concentrated in three colonies (USFWS 1998). In the State of Maine, the Maine Coastal Island National Wildlife Refuge (MCINWR) manages 95% of roseate tern nesting habitat. In 2007, an estimated 227 pairs nested on five islands (USFWS 2008). Intensive management of habitat and gulls has been undertaken at the MCINWR since 1984.

The major limiting factors for roseate terns continues to be attributed to the loss of nesting sites and predation; both caused largely by expanding populations of gulls (herring, great black-backed, and laughing gulls) (see Figure 1-2). Because roseate tern nesting islands were lost to erosion and overtaken by nesting gulls, the remaining terns were forced to nest on islands located closer to the mainland, which subjected them to other forms of predation such as owls, fox, and mink. The primary objective of the roseate tern recovery program is to promote an increase in breeding population size, distribution, and productivity to warrant reclassification to threatened status and eventual delisting.

Figure 1-2. The number of breeding pairs of roseate tern and laughing gulls in Maine, 1977-2011



Historic Management of Piping Plovers in Maine

Numerous federal regulatory mechanisms have protected piping plovers in Maine since the enactment of the MBTA. Due to increased development and recreational use of beaches since the end of World War II, piping plovers have continued to decline, and by 1981, only seven pairs could be found in Maine (MDIFW 2011*a*). In 1986, piping plovers were added to the list of state-endangered species in Maine and were considered a threatened species under the ESA. A state recovery plan was written for plovers in 1990 (MDIFW 2011*a*). Maine Revised Statutes (MRS) further protected the nesting, feeding, and brood-rearing habitats of piping plovers by designating Essential Habitat in 1995 (see 12 MRS §12804; MDIFW 2011*a*). Essential Habitat designation requires that all projects funded, permitted, and carried out by

municipalities and state agencies in mapped areas must be reviewed by the MDIFW.

Piping plover conservation and management efforts have been a cooperative venture since 1981. The MDIFW, Rachel Carson National Wildlife Refuge (RCNWR), Maine Audubon, the Nature Conservancy, multiple municipalities, and local landowners work collaboratively to achieve conservation of piping plovers. Each year in April, plover territories on beaches are fenced and signed. Those areas offer refuge from human disturbance for nesting birds and recently fledged chicks. Surveys and monitoring of individual plovers continue throughout the entire nesting season. In most cases, wire mesh exclosures are placed around nests as soon as they are found to prevent predation by birds and mammals. These exclosures have demonstrated success in Maine at deterring some predation events; however, in other regions, abandonment and systematic predation has occurred from the use of exclosures due to predators associating the exclosures with the presence of a nest (USFWS 2009). If the presence of nest exclosures were attributed to the abandonment and predation events in Maine, enclosing nests would be discontinued. Biologists and wardens patrol nesting areas several times weekly to deter dogs, educate the public, and monitor nests and chicks. Prior to 2007, only limited predation management was conducted to enhance nesting success of plovers. Those activities typically only targeted specific individual predators for short periods. During the nesting seasons from 2007 through 2011, WS was requested to provide more intensive predation management assistance at several key nesting beaches. Population and productivity data were collected each year to monitor population health and recovery status. In five years, 80 piping plover pairs produced 157 fledglings (1.96 productivity rate) on beaches with predation management. In contrast, 70 pairs produced only 87 fledglings (1.24 productivity rate) on beaches without predation management (WS and Maine Audubon, unpublished data). Data from WS' monitoring activities appears to show that beaches with predation management had a 58% higher productivity rate than those beaches without predation management during the past five years.

Historic Management of Least Terns in Maine

Least terns were first recorded nesting in Maine in 1961 after being locally extirpated by subsistence and commercial hunting. Since that time, nesting colonies have been documented at 13 sites. Populations have been monitored since 1977, and the population has fluctuated between 39 pairs in 1982 and 212 pairs in 2010 (Camuso et al. 2011).

The east coast population of least terns is listed as a Species of Management Concern by the USFWS (MDIFW 2011*b*). They were listed as the first endangered species in Maine during 1982. A state recovery plan was written for least terns in Maine during 1993 (MDIFW 2011*b*). Least tern nesting, feeding, and brood-rearing habitats were given legal protection in Maine by designating these areas as Essential Habitats in 1995 (MDIFW 2011*b*). Because of the Essential Habitat designation, all projects or activities funded and carried out by municipalities and state agencies that occur in those designated areas are reviewed by the MDIFW. Least tern numbers have not increased substantially despite two decades of intensive management (MDIFW 2011*b*).

Least terns nest in similar habitats as piping plovers, and much of the management actions for the two species are analogous. Nesting areas on beaches are fenced and signed; thus, limiting human disturbance. However, chronic predation and human disturbance are major factors limiting populations, and entire colonies can be lost in a single night from these causes (MDIFW 2011*b*). In many years, only a handful of young are fledged. Electric fencing and large wire mesh fences have been employed to deter predators, with mixed results. Prior to 2007, predator removal (especially removal of resident pairs of fox) was utilized, but was not proven effective. During the nesting seasons from 2007 through 2011, WS provided more intensive predation management assistance at several key nesting beaches with mixed results. Nightly monitoring of colonies has also been used to deter predators. Biologists and wardens patrol nesting areas several times weekly to deter dogs, educate the public, and monitor nests and chicks.

Population and productivity data are collected each year to monitor population health and recovery status. Overall, the numbers of nesting least terns in Maine has steadily increased since 2005 (Camuso et al. 2011).

Historic Management of Roseate Terns in Maine

A great deal of effort has been expended in the restoration of roseate terns since their initial endangered listing by the USFWS in 1987, with intensive management occurring on a few nesting islands. Ten Maine nesting islands are currently managed for terns and include Eastern Brothers, Petit Manan, Metinic, Seal, Eastern Egg Rock, Matinicus Rock, Pond, Jenny, Stratton, and Outer Green Islands (MDIFW 2011*c*). On each of these islands, gulls are removed or controlled, decoys and sound recordings of colonies are used to attract nesting terns, and tern managers live on the islands during the nesting season to deter predators and control human disturbance. Roseate tern numbers respond well to management, and about 289 pairs nested on four islands in the state in 2001 (MDIFW 2011*c*). However, since 2001, roseate terns in Maine have declined, with only 151 pairs nesting in the state during 2011 (Gulf of Maine Seabird Working Group, unpublished data). Most of Maine's breeding population nests on only three islands (Eastern Egg Rock, Stratton, and Jenny Islands) and the birds have yet to recolonize many of their historic nesting areas. Roseate tern nesting islands are designated as Essential Habitats under the Maine Endangered Species Act, Significant Wildlife Habitats under the Maine Natural Resource Protection Act, or as Protection Fish and Wildlife areas under the Land Use Regulation Commission (MDIFW 2011*c*). Because of the Essential Habitat designation, all projects or activities funded and carried out by municipalities and state agencies within 0.25 miles of roseate tern nesting islands must be reviewed by the MDIFW (MDIFW 2011*c*).

1.3 SCOPE OF THIS ENVIRONMENTAL ASSESSMENT

Actions Analyzed

This EA evaluates the need for managing nest predation to enhance nesting success rates by reducing threats of predation on eggs and nestlings of ground nesting bird species along the beaches and coastal islands within the State of Maine. This EA discusses the issues associated with conducting activities to meet the need for action and evaluates different alternatives to meeting that need while addressing those issues.

The methods available for use or recommendation under each of the alternatives evaluated are provided in Appendix B[4]. The alternatives and Appendix B also discuss how methods would be employed to manage nest predation in the State. Therefore, the actions evaluated in this EA are the use of those methods available under the alternatives and the employment of those methods by WS and the cooperating agencies to manage or prevent nest predation from occurring when permitted by the MDIFW and the USFWS. In addition, this EA evaluates the permitting of bird take by the USFWS to other entities to address avian damage in the State.

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

[4]A complete list of chemical and non-chemical methods available for use under the identified alternatives, except the alternative with no damage management (Alternative 1), can be found in Appendix B. However, listing methods neither implies that all methods would be used to resolve requests for assistance nor does the listing of methods imply that all methods would be used to resolve every request for assistance.

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

The USFWS is a cooperating agency on this EA to analyze cumulative take of those bird species addressed in this EA from the issuance of depredation permits to entities within the State and to ensure compliance with the NEPA. The USFWS has jurisdiction over the management of migratory birds and has specialized expertise in identifying and quantifying potential effects to the human environment from activities to alleviate predation risks and activities associated with T&E species. The analyses in this EA would ensure the USFWS compliance with the NEPA for the issuance of depredation permits for the take of those birds species addressed and for the issuance of funding to implement nest predator management to reduce predation risks of T&E species.

Native American Lands and Tribes

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

Period for which this EA is Valid

If the analyses in this EA indicate an Environmental Impact Statement (EIS) is not warranted, this EA would remain valid until WS and the USFWS determines that a new need for action, changed conditions, new issues, or new alternatives having different environmental impacts must be analyzed. At that time, this analysis and document would be reviewed and supplemented pursuant to the NEPA. Review of the EA would occur to ensure that activities conducted under the selected alternative remained within the parameters evaluated in the EA. If the alternative analyzing no involvement by WS were selected, no subsequent review of the EA would occur based on the lack of involvement. Monitoring of activities would ensure the EA remains appropriate to the scope of management activities conducted in Maine under the selected alternative if an EIS was not warranted.

Site Specificity

This EA analyzes the potential impacts of addressing nest predation on private and public lands in Maine based on information gathered from previous activities conducted. The EA also addresses the potential impacts of addressing nest predation on additional areas in the State where nest predation could be a concern. Because the goals and directives of WS and the cooperators are to provide services when requested, within the constraints of available funding and workforce, it is conceivable that additional efforts to address nest predation could occur. Thus, this EA anticipates those additional activities and analyzes the impacts of such efforts as part of the alternatives.

Those species of wildlife that are known nest predators in the State can be found in local abundance throughout the year in Maine. Planning for the management of nest predation risks 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 and police departments, emergency clean-up organizations, and insurance companies. Although some of the sites where nest predation could occur can be predicted, specific locations or times where predation would occur in any given year cannot be predicted. This EA emphasizes major issues as those issues relate to specific areas whenever possible; however, many issues apply wherever predation and the resulting management activities occur, and are treated as such. Chapter 2 of this EA identifies and discusses issues relating to addressing nest predation in Maine. The standard WS Decision Model (Slate et al. 1992) would be the site-specific procedure for individual actions conducted by WS in Maine (see Chapter 3 for a description of the Decision Model and its application along with Appendix J). Decisions made using the model would be in accordance with WS' directives and SOPs described in this EA. Decisions associated with the issuance of depredation permits and providing funding by the USFWS would occur in accordance with the policy and guidelines of the USFWS.

Under three of the alternatives, WS could continue to provide assistance with managing nest predation on federal, State, county, municipal, and private land in Maine when a request is received for such services by the appropriate property owner or manager. In those cases where a federal agency requests WS' assistance with managing predation caused by nest predators, 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.

The analyses in this EA are intended to apply to any action that may occur in any locale and at any time within Maine where nesting of piping plovers, least terns, and roseate terns has occurred or could occur. In this way, the EA meets the intent of the NEPA with regard to site-specific analysis and that this approach is the only practical way for WS and the USFWS to comply with the NEPA and still be able to address nest predation in the State.

Piping Plover Nesting Habitat

Since 1981, piping plovers have nested at 26 different locations in Maine (see Appendix C; MDIFW 2011*a*). These locations are located in the southern one-third of Maine in York, Cumberland, and Sagadahoc Counties (see Figure 1-3). From 2007 through 2011, WS performed predation management at only seven of these locations (see Figure 1-4). This EA considers all historic nesting locations of piping plovers as well as any potential new nesting sites within the State of Maine.

Least Tern Nesting Habitat

Since 1977, least terns have nested at 13 different locations in Maine (see Appendix D; MDIFW 2011*b*). These locations are located in the southern one-third of Maine in York and Cumberland Counties (see Figure 1-3), 12 of the sites are on the mainland, and one is on Stratton Island. From 2007 through 2011, WS performed predation management at only four of these locations (see Figure 1-5). This EA considers all historic nesting locations of least terns as well as any potential new nesting sites within the state of Maine.

Figure 1-3. The known nesting locations of piping plovers and least terns in Maine, indicating areas with Essential Habitat designation.

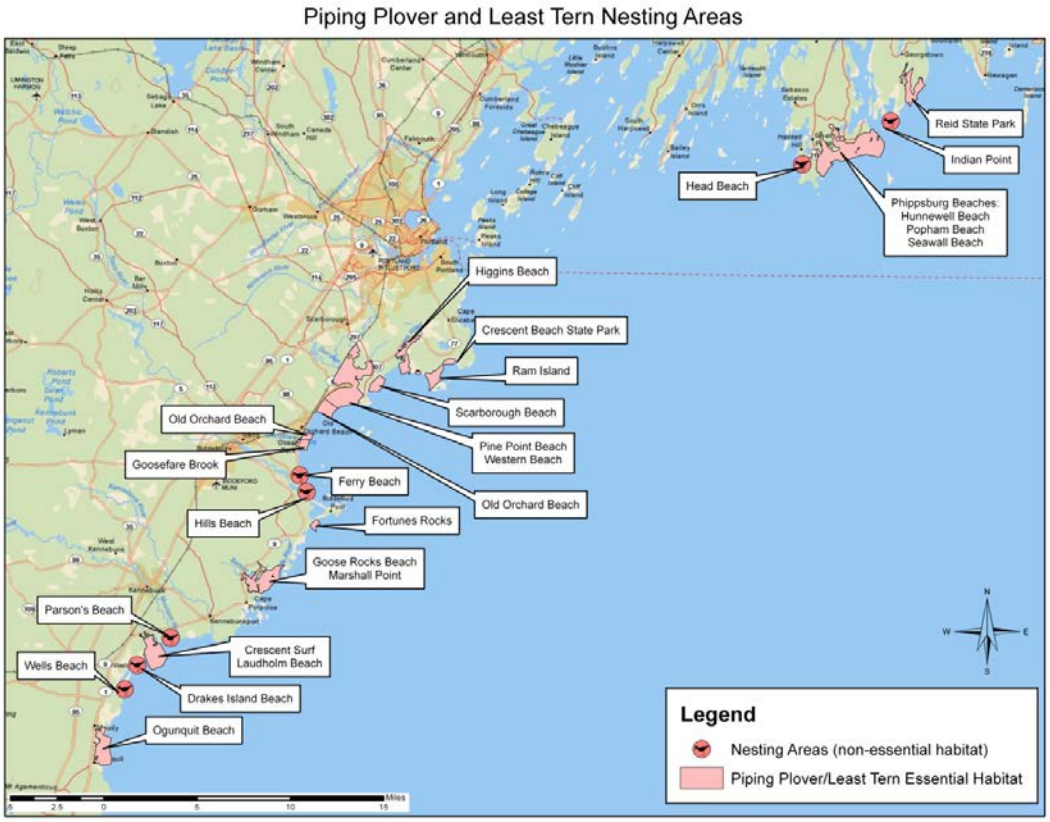


Figure 1-4. The location of seven piping plover nesting areas where predator management was conducted by WS from May 2007 through August 2011.

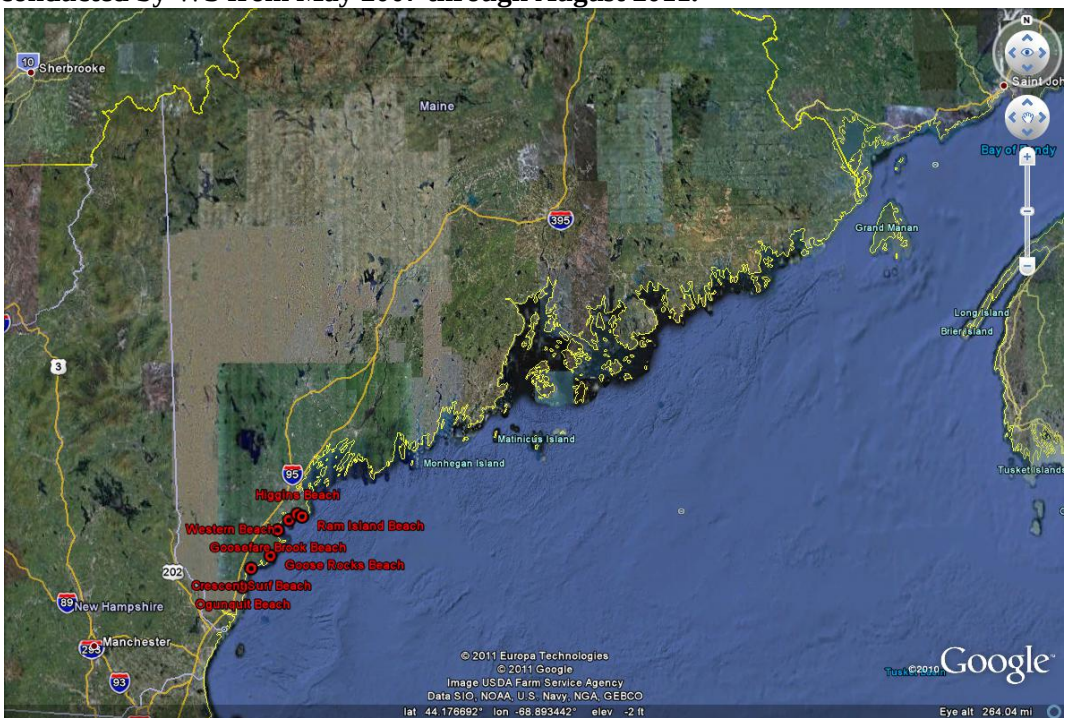
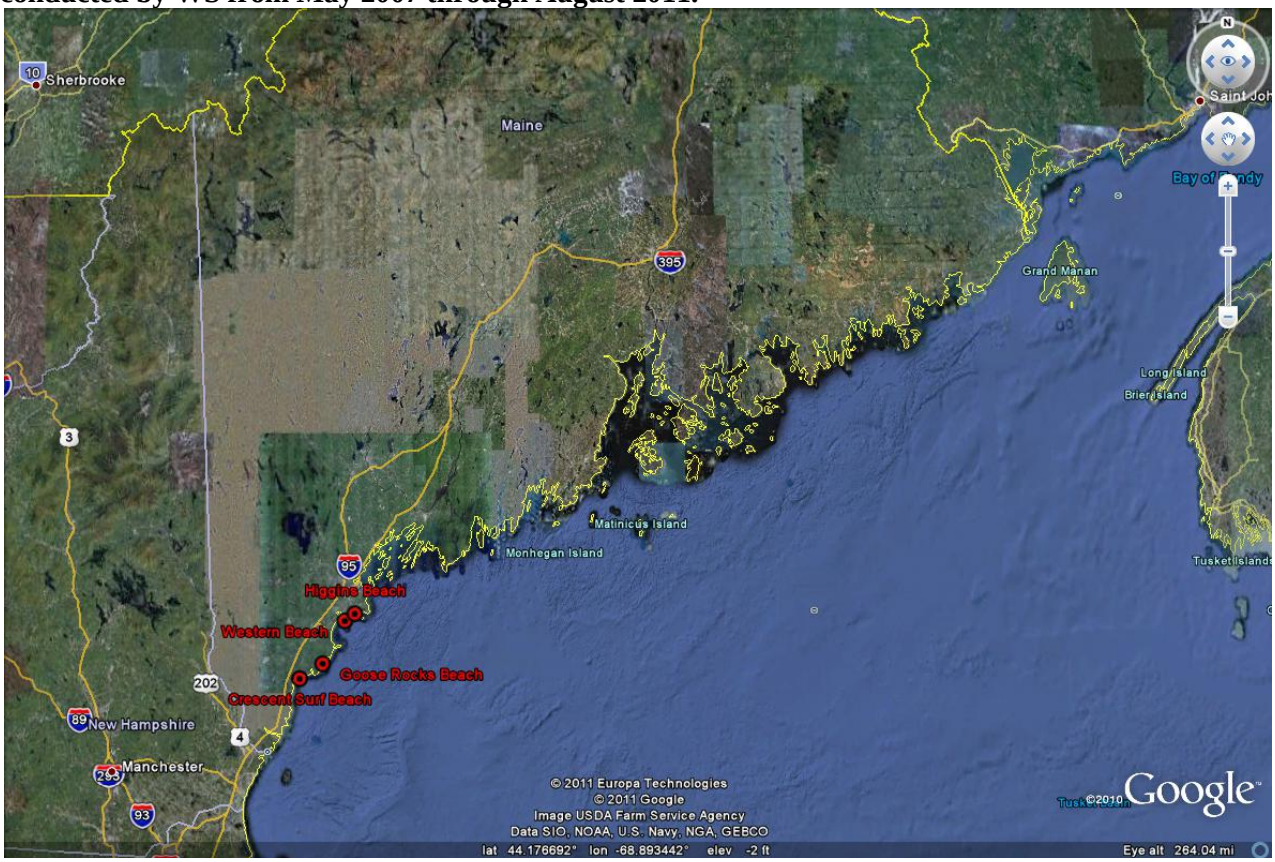


Figure 1-5. The location of four least tern nesting areas where predator management was conducted by WS from May 2007 through August 2011.



Roseate Tern Nesting Habitat

Of the 3,000 islands off the coast of Maine, at least 150 have been used by nesting terns in the last century. Figure 1-6 shows more recently occurring nesting locations by roseate terns. In recent years, only four to six islands have been used by roseate terns (see Appendix E; MDIFW 2011*c*). WS has not conducted any predation management operations for roseate terns. This EA considers all historic nesting locations of roseate terns as well as any potential new nesting sites within the State of Maine.

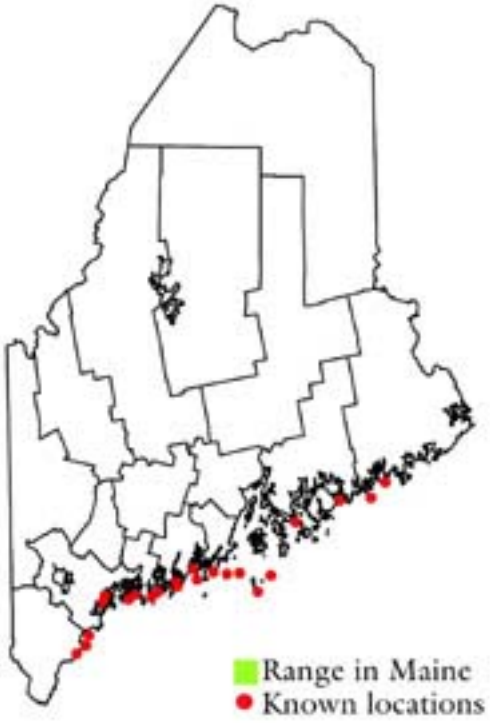
Summary of Public Involvement

Issues related to managing nest predation were initially developed by WS in cooperation with the USFWS and during consultation with the MDIFW. Issues were defined and preliminary alternatives were identified through the scoping process, primarily during an interagency meeting held on October 27, 2009 and during subsequent discussions and review of this document. Individuals that had previously expressed concerns and support of the program were invited to a public scoping meeting held in Kennebunk, Maine on January 27, 2010. In addition, and as required by the Council on Environmental Quality (CEQ) and APHIS' NEPA implementing regulations, this document will be noticed to the public through legal notices published in local print media, through direct mailings to parties that have requested to be notified or have been identified to have an interest in the reduction of nest predation on ground nesting waterbirds in Maine, and by posting the EA on the APHIS website at http://www.aphis.usda.gov/wildlife_damage/nepa.shtml.

WS and the USFWS will provide for a minimum of a 30-day comment period for the public and

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

Figure 1-6. The known nesting locations of roseate terns in Maine (MDIFW 2011*c*).



1.4 RELATIONSHIP OF THIS DOCUMENT TO OTHER ENVIRONMENTAL DOCUMENTS

***WS' Programmatic Final Environmental Impact Statement*:** WS has developed a programmatic Final Environmental Impact Statement (FEIS) that addresses the need for wildlife damage management in the United States (USDA 1997). The FEIS contains detailed discussions of potential impacts to the human environment from methods available to manage wildlife damage. In addition, the FEIS contains risk assessments of many of the methods available to manage damage (USDA 1997).

***Gull Damage Management Environmental Assessment*:** WS has also developed an EA that analyzes the need for action to manage damage associated with herring gulls, ring-billed gulls, great black-backed gulls, and laughing gulls. The EA identified the issues associated with managing damage associated with gulls in the State and analyzed alternative approaches to meet that need while addressing the identified issues (USDA 2010). Based on the analyses in the EA, a Decision and Finding of No Significant Impact (FONSI) were signed on September 24, 2010, which selected the proposed action alternative. The proposed action alternative addressed the implementation of an adaptive approach to managing damage using multiple methods that are integrated together to meet the need for action.

Laughing Gull Management Plan for Seabird Restoration Islands in Maine Environmental

Assessment: The MCINWR has issued an EA on the effects of reducing the number of laughing gulls breeding on four islands in Maine to increase the productivity of Arctic terns, common terns, and roseate terns (USFWS 2008).

Reducing Pigeon, Starling, Sparrow, Blackbird, Raven, and Crow Damage Through an Integrated Wildlife Damage Management Program in the State of Maine Environmental Assessment: WS has developed an EA that assesses the effects of managing damage caused by rock pigeons, European starlings, house sparrows, red-winged blackbirds, brown-headed cowbirds, common grackles, common ravens, and American crows in the State of Maine (USDA 2001*a*). The EA was supplemented and a new Decision was issued in 2009.

Piping Plover Atlantic Coast Population Revised Recovery Plan: This document serves as the official Species Recovery Plan, as identified under the ESA, which describes protocols for protecting and enhancing the listed species. This document specifies what research and management actions would be necessary to support recovery, but the plan does not commit work force or funds. The recovery plan is also used when setting funding priorities and provides direction to local, regional, and state planning efforts (USFWS 1996).

Roseate Tern Northeastern Population Recovery Plan: This document serves as the official Species Recovery Plan for the roseate tern. The Plan specifies what research and management actions would be necessary to support recovery. The recovery plan is also used when setting funding priorities and provides direction to local, regional, and state planning efforts (USFWS 1998).

Piping Plover Assessment: The MDIFW has prepared a piping plover species assessment to identify the status of the population, what factors are affecting population levels, to help balance the desires of certain user groups, and to set management goals and objectives for the species (McCollough 2000).

Piping Plover Management System and Database: This document describes the system by which the MDIFW makes decisions concerning management of the state-endangered piping plover. The document outlines the decision-making process and details techniques for measuring biological and habitat parameters used as inputs for decision-making and documents databases for storage of biological and habitat information (MDIFW 2007*a*).

Least Tern Assessment: The MDIFW has prepared a least tern species assessment to identify the status of the population, what factors are affecting population levels, to help balance the desires of certain user groups, and to set management goals and objectives for the species (McCollough 1993).

Least Tern Management System and Database: This document describes the system by which the MDIFW makes decisions concerning management of the state-endangered least tern. The document outlines the decision-making process and details techniques for measuring biological and habitat parameters used as inputs for decision-making and documents databases for storage of biological and habitat information (MDIFW 2007*b*).

Island-Nesting Terns Assessment: The MDIFW has prepared a species assessment for island nesting terns to identify the status of the population, what factors are affecting population levels, to help balance the desires of certain user groups, and to set management goals and objectives for the species (MDIFW 2006).

Island-Nesting Terns Management System and Database: This document describes the system by which the MDIFW makes decisions concerning management of the state-endangered roseate tern. The document outlines the decision-making process and details techniques for measuring biological and

habitat parameters used as inputs for decision-making and documents databases for storage of biological and habitat information (MDIFW 2009).

Rachel Carson National Wildlife Refuge Final Comprehensive Conservation Plan (CCP) and Environmental Assessment: This document describes the desired future conditions of the RCNWR and provides long-range guidance and management direction to achieve the purposes of the refuge; helps fulfill the mission of the Refuge System; maintains and, where appropriate, restores the ecological integrity of the refuge; helps achieve the goals of the National Wilderness Preservation System; and meets other mandates (USFWS 2007). The National Wildlife Refuge System Improvement Act of 1997 (PL 105–57) mandates that the USFWS write CCPs for all national wildlife refuges and reevaluate them every 15 years or as needed. The NEPA mandates that the USFWS develop either an environmental assessment or an environmental impact statement in the CCP. The planning project provides a unique opportunity for the USFWS to involve individuals and local communities in the long-term management of the refuge.

1.5 AUTHORITY OF FEDERAL AND STATE AGENCIES

The authorities of WS, the USFWS, and other agencies, as those authorities relate to reducing nest predation of T&E species, are discussed by agency below:

WS' Legislative Authority

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

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 that are listed as threatened or endangered under the ESA. The take of migratory birds is prohibited by the MBTA. However, the USFWS can issue depredation permits for the take of migratory birds when certain criteria are met pursuant to the MBTA. Depredation permits are issued to take migratory birds to alleviate damage and threats of damage. Under the permitting application process, the USFWS requires applicants to describe prior non-lethal damage management techniques that have been used. In addition, the USFWS can establish depredation orders that allow for the take of those migratory birds addressed in the depredation orders when those bird species are causing or 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. The goals and objectives of the Migratory Bird Program within the USFWS are to protect, restore, and manage migratory bird populations. The Wildlife and Sport Fish Restoration Program works with states and other entities to conserve, protect, and enhance fish, wildlife, their habitats, and the hunting, fishing, and recreational opportunities wildlife provides through grant programs. The goal and mission of the Ecological Services offices is to help recover T&E species and to collaborate with property owners to restore fish and wildlife habitats.

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.

Maine Department of Agriculture Board of Pesticides Control (MDABPC)

The MDABPC carries out the day-to-day responsibilities of regulating pesticides in the State of Maine and helps to protect people and the environment by ensuring the safe and appropriate use of pesticides. The main goal of the MDABPC is to prevent adverse human health or environmental effects from the misuse of pesticides. The MDABPC is responsible for enforcing all pesticide regulations and laws, both state and federal. It is responsible for carrying out provisions of the Maine Pesticide Control Act. These responsibilities include the registration of pesticides, controlling the pesticide products being used in the State, certification of pesticide applicators and enforcement of pesticide use as specified on labels. Through cooperative agreements with the EPA, the department also implements provisions of the FIFRA.

Maine Department of Inland Fisheries and Wildlife

The MDIFW has authority in wildlife management given under Maine Revised Statutes Annotated Title 12. The legislation covers general provisions; licenses, permits and stamps generally; wildlife; fish; wild animals and threatened and endangered species. The MDIFW also has authority to conduct conservation actions for federally listed T&E species under a cooperative agreement with the USFWS. The MDIFW is responsible for preserving, protecting, and enhancing the inland fisheries and wildlife resources of the State.

1.6 COMPLIANCE WITH LAWS AND STATUTES

Several laws or statutes authorize, regulate, or otherwise affect WS' activities. WS complies 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.

National Environmental Policy Act

All federal actions are subject to the NEPA (PL 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 Implementation of the NEPA Procedures, as published in the Federal Register (44 CFR 50381-50384) provide guidance to APHIS regarding the NEPA process.

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

The NEPA requires federal agencies to incorporate environmental planning into federal agency actions and decision-making processes. The two primary objectives of the NEPA are: 1) agencies must have available and fully consider detailed information regarding environmental effects of federal actions and 2) agencies must make information regarding environmental effects available to interested persons and agencies before decisions are made and before actions are taken.

This EA will assist WS and the cooperating agencies in determining whether potential environmental impacts caused by the alternatives might be significant, requiring the preparation of an EIS. The development of this EA documents the incorporation of environmental planning into the actions and decision-making process to ensure compliance with the NEPA requirement for the activities proposed in the State.

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

The MBTA provides the USFWS regulatory authority to protect families of migratory birds. The law prohibits any "*take*" of migratory bird species by any entity, 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. All actions conducted in this EA would comply with the regulations of the MBTA, as amended.

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. The bird species that can be lethally taken under the blackbird depredation order that are addressed in this EA include American crows.

Endangered Species Act

Activities described in this EA would be in response to the responsibilities specified in the ESA that *"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)), and "*all other Federal agencies shall…utilize their authorities in furtherance of the purposes of this Act by carrying out programs for the conservation of endangered species and threatened species listed pursuant to section 4 of this Act* (Sec. 7 (a) (1)).

WS also conducts Section 7 consultations with the USFWS to ensure that "*any action authorized, funded or carried out by such an agency . . . is not likely to jeopardize the continued existence of any endangered or threatened species . . . Each agency will use the best scientific and commercial data available*" (Sec.7 (a) (2)).

As part of the development of this EA, WS has also consulted with the USFWS regarding T&E species in Maine in regards to nest predator damage management activities proposed, which is discussed in Chapter 4 of this EA.

Maine Endangered Species Act

The Maine Endangered Species Act was passed by the Maine Legislature in 1975 due to concern that various species of fish and wildlife were in danger of disappearing from the State. This Act provides the foundation for Maine's Endangered Species Program. Authority to oversee implementation of the Act resides with the Commissioner of the Department of Inland Fisheries and Wildlife. The purpose of Maine's Endangered Species Act is to insure that native species continue to survive in Maine. The Maine Endangered Species Act applies only to animals; plants are not included in the legislation.

Federal Insecticide, Fungicide, and Rodenticide Act

The FIFRA requires the registration, classification, and regulation of all pesticides used in the United States. The EPA is responsible for implementing and enforcing the FIFRA. All chemical methods that would be available for use under the alternatives would be registered with and regulated by the EPA, the MDIFW, and/or the MDABPC, and used by WS in compliance with labeling procedures and requirements.

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

The NHPA of 1966, and its implementing regulations (36 CFR 800), requires federal agencies to: 1) determine whether activities they propose constitute "*undertakings*" that have the potential to cause effects on historic properties and 2) if so, to evaluate the effects of such undertakings on historic resources and consult with the Advisory Council on Historic Preservation, as appropriate. Actions on tribal lands would only be conducted at the tribe's request and under signed agreements; thus, the tribes would have control over any potential conflict with cultural resources on tribal properties.

Each method described in this EA that could be used under the alternatives does not cause major ground disturbance, does not cause any physical destruction or damage to property, does not cause any alterations of property, wildlife habitat, or landscapes, and does not involve 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 would be used by WS under the alternatives would not generally be 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, then site-specific consultation, as required by Section 106 of the NHPA, would be conducted as necessary.

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. In preparation of this EA, it was determined that the predation management program does not require review under the enforceable policies of Maine's coastal program, and consequently, its review under the Coastal Zone Management Act's federal consistency provision is not required (K. Layden, Maine Coastal Program pers. comm. 2011).

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 Food and Drug Administration (FDA).

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 Drug Enforcement Administration to possess controlled substances, including those that are used in wildlife capture and handling.

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 to alleviate predation risks. 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 drugs and euthanasia chemicals. Veterinary authorities in each state have the discretion under this law to establish withdrawal times (*i.e.*, a period 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.

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. Chemicals methods employed by WS would be regulated by the EPA through FIFRA, the MDABPC, 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 makes it a high priority to identify and assess environmental health and safety risks that may disproportionately affect children. WS has considered the impacts that this proposal might have on children. The proposed 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.

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

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

The Native American Graves and Repatriation Act of 1990

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

1.7 DECISIONS TO BE MADE

Based on agency relationships, MOUs, and legislative authorities, WS is the lead agency for this EA, and therefore, responsible for the scope, content, and decisions made. The management of migratory birds is the responsibility of the USFWS. As the authority for the management of bird populations, the USFWS was involved in the development of the EA and provided input throughout the EA preparation process to ensure an interdisciplinary approach according to the NEPA and agency mandates, policies, and regulations. The Wildlife and Sport Fish Restoration Program within the USFWS works with states and other entities to conserve, protect, and enhance fish, wildlife, their habitats, and the hunting, fishing, and recreational opportunities wildlife provides through grant programs. The goal and mission of the Ecological Services offices within the USFWS is to help recover T&E species and to collaborate with property owners to restore fish and wildlife habitats. The MDIFW is responsible for managing wildlife in

the State, including those species of wildlife identified as nest predators. The MDIFW establishes and enforces regulated hunting and trapping seasons in the State. Any activities to reduce and/or prevent nest predation in Maine would be coordinated with the USFWS and the MDIFW, which ensure activities conducted under the alternatives would be incorporated into population objectives established by those agencies for wildlife populations in the State. The USFWS cooperated with WS on the development of the EA and the MDIFW was consulted to identify issues, alternatives, and to ensure compliance with federal and State laws and regulations.

Based on the scope of this EA, the decisions to be made are: 1) should WS, in cooperation with the USFWS, continue to conduct activities to alleviate and prevent predation on ground nesting T&E species, 2) should the Migratory Bird Program in Region 5 of the USFWS issue depredation permits to WS and other entities to conduct activities to alleviate nest predation, 3) should funding be provided to WS by the USFWS to address nest predation, 4) should WS implement an adaptive integrated methods strategy, including technical assistance and direct operational assistance, to meet the need to alleviate predation risks in Maine, 5) if not, should WS attempt to implement one of the alternatives to an integrated methods strategy as described in the EA, and 6) would the proposed action or the other alternatives result in impacts to the environment requiring the preparation of an EIS.

CHAPTER 2: AFFECTED ENVIRONMENT AND ISSUES

Chapter 2 contains a discussion of the issues, including issues that will receive detailed environmental impact analysis in Chapter 4 (Environmental Consequences), issues that have driven the development of standard operating procedures (SOP), 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 issues. Additional descriptions of affected environments will be incorporated into the discussion of the environmental effects in Chapter 4.

2.1 AFFECTED ENVIRONMENT

Predation management conducted under the alternatives to protect nesting piping plovers, least terns, and roseate terns would be limited to proximal areas to where those birds nest during the nesting season.

Piping Plovers

Piping plovers along the Atlantic Coast nest on coastal beaches above the high tide line, sand flats at the ends of sand spits and barrier islands, gently sloping foredunes, blowout areas behind primary dunes, and washover areas cut into or between dunes. They may also nest on areas where suitable dredge spoils have been deposited. Nest sites are relatively flat with substrates ranging from fine sand to mixtures of sand, shells, pebbles, or cobble. Nests of piping plovers occur most commonly at sites with little or no vegetation, but may be found in moderately dense stands of beach grass (*Ammophila brevicata*) (McCollough 2000). Piping plovers breed and nest on sandy beach habitats in York, Cumberland, and Sagadahoc Counties in Maine from late March to August of each year. Those habitats are often considered limited, and since 1981, piping plovers have only nested at 26 different locations (see Appendix C). During the 2008 season, piping plovers nested at only 11 beaches (Camuso et al. 2011). Figure 1-3 indicates the areas where historic nesting has occurred within the State, and identifies areas that have been designated as Essential Habitat by the MDIFW for least terns and/or piping plovers.

Least Terns

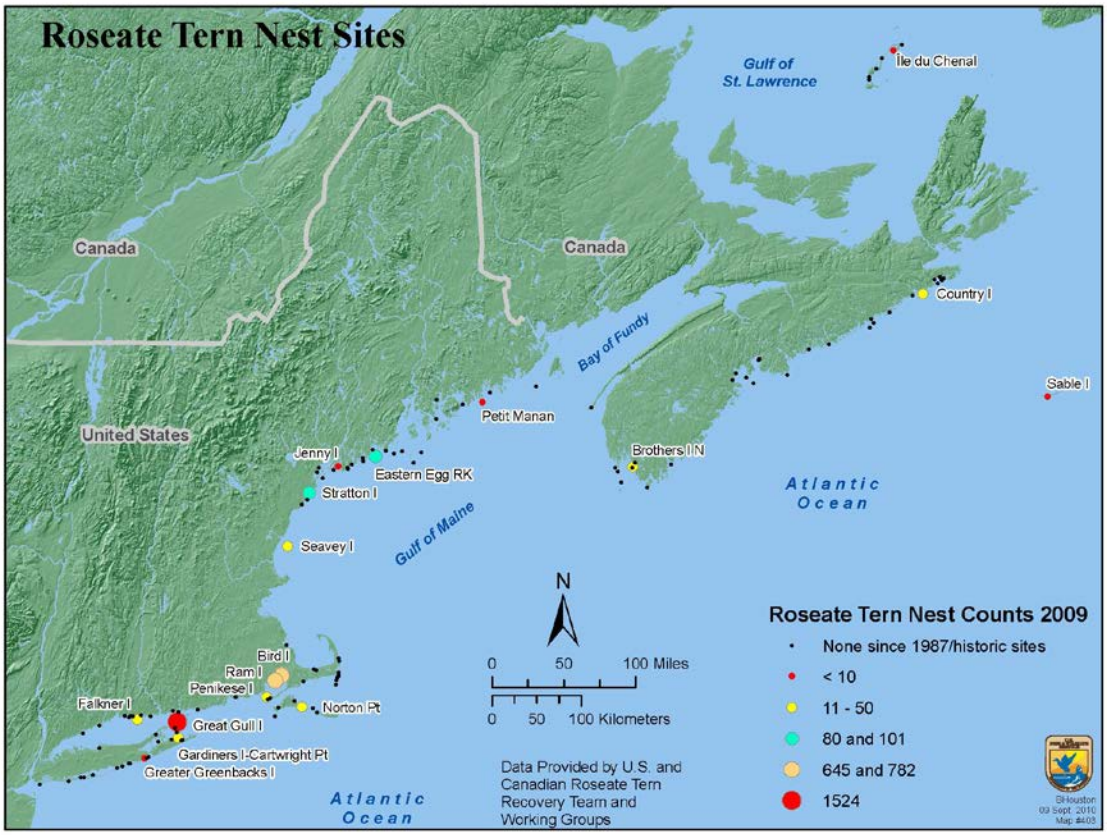
In Maine, least terns nest exclusively in scattered colonies on points and spits of sand beaches south of the Kennebec River. These sand beaches are characterized by highly dynamic areas of accretion and erosion,

sparse vegetation, and coarse sand, gravel, and bits of broken shells (McCollough 1993). Least terns arrive at breeding sites on southern Maine beaches from late April to early June, but the majority of nests are established by late May, and departure from colony sites occurs by early September (McCollough 1993). Between 1977 and 2010, least terns have used 13 nesting areas (beaches) in Maine (see Appendix D; Camuso et al. 2011). Between 2007 and 2010, least terns only utilized five beaches in total; however, during each of those years, two locations hosted over 90% of the least terns in Maine (Camuso et al. 2011). Figure 1-3 indicates the areas where historic nesting has occurred within the State, and identifies areas that have been designated as Essential Habitat for least terns and/or piping plovers.

Roseate Terns

Roseate terns are exclusively a marine species, nesting on rocky or sandy islands, barrier beaches, or salt marsh islands. In the northeastern United States, roseate terns generally nest under dense vegetation, rocks, or driftwood (MDIFW 2006). Roseate tern colonies are usually found on barrier beaches that have good cover, are predator-free, and are close to an abundant supply of available prey. All recent records of roseate tern nesting colonies in the northeastern United States are associated with common tern colonies (USFWS 1998). Roseate terns have a wide geographic distribution in Maine (Lincoln, Knox, Hancock, and Washington Counties), but because they are island nesters, they are limited by suitable habitat. Roseate terns occupied only five nesting islands during the 2007 season (USFWS 2008), but have nested on 25 different islands since 1977 (see Appendix E). Figure 2-1 indicates the areas within northeastern North America, including 25 Maine islands, where roseate terns have nested since 1987.

Figure 2-1. The known nesting sites of roseate terns in northeastern North America since 1987.



2.2 ISSUES ADDRESSED IN THE ANALYSIS OF ALTERNATIVES

Issues are concerns of the public and/or professional community raised regarding potential impacts that might occur from a proposed activity. Such issues must be considered in the decision-making process in accordance with the NEPA. Issues related to managing nest predation in Maine were developed by WS in cooperation with the USFWS and consultation with the MDIFW. Additional issues were identified during a public scoping session that occurred in Kennebunk, Maine on January 27, 2010. WS, the USFWS, and the MDIFW invited citizens who expressed concern about the program to participate in the scoping event, and that process served to identify numerous issues. The EA will also be made available to the public for further 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 are the following:

Issue 1 - Effects of Activities on Target Wildlife Populations

A common issue when addressing predation caused by wildlife are the potential impacts of management actions on the population of target species. Methods available to reduce risks of nest predation are categorized into non-lethal methods and lethal methods. Non-lethal methods can disperse or otherwise make an area unattractive to target species, which reduces the presence of those species at the site, and potentially the immediate area around the site. Lethal methods could be employed to remove an individual animal or those individuals responsible for feeding on the eggs, nestlings, and/or adults of plovers and terns. Therefore, employing lethal methods could result in temporary, local population reductions in the area where activities were conducted to reduce or prevent nest predation. The number of target species removed from the population using lethal methods would be dependent on the number of requests for assistance received, the number of individuals of a wildlife species involved with the associated predation, and the efficacy of methods employed.

The analysis for magnitude of impact on populations from the use of lethal methods would be based on a measure of the number of animals killed in relation to their 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 data, when available. Take would be monitored by comparing the number of animals killed with overall populations or trends in populations to assure the magnitude of take was maintained below the level that would cause significant adverse impacts to the viability of a native species population. Under the alternatives where lethal methods could be employed or recommended, the lethal take (killing) of wildlife would only occur at the request of a cooperator seeking assistance and only after the take of those wildlife species identified as targets had been permitted by the USFWS, when required, and by the MDIFW, when required.

Information on bird populations and trends are often derived from several sources including the Breeding Bird Survey (BBS), the Christmas Bird Count (CBC), and the Partners in Flight Landbird Population database. Information on mammalian wildlife is often derived from published literature, trends, surveys, and harvest data. Further information on particular sources of information is provided below.

Breeding Bird Survey

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

breeding in the immediate area. The BBS is conducted annually in the United States, across a large geographical area, under standardized survey guidelines. The BBS is a large-scale inventory of North American birds coordinated by the United States Geological Survey, Patuxent Wildlife Research Center (Sauer et al. 2011). The BBS is a combined set of over 3,700 roadside survey routes primarily covering the continental United States and southern Canada. The primary objective of the BBS has been to generate an estimate of population change for all breeding birds. Populations of birds tend to fluctuate, especially locally, 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. 2011).

Christmas Bird Count

The CBC is conducted in December and early January annually by numerous volunteers under the guidance of the National Audubon Society. The CBC reflects the number of birds frequenting a location during the winter months. CBC 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. Researchers have found that population trends reflected in CBC data tend to correlate well with those from censuses taken by more stringent means (National Audubon Society 2010).

Partners in Flight Landbird Population Estimate

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

Bird Conservation Regions

BCRs are areas in North America that are characterized by distinct ecological habitats that have similar bird communities and resource management issues. The State of Maine lies almost entirely within the Atlantic Northern Forest region (BCR 14). This region is characterized by nutrient-poor soils that support spruce-fir forests in the northerly portion of the region and higher elevations of the Adirondack Mountains, while hardwood forests dominate elsewhere. BCR 14 encompasses most of Maine, Vermont, New Hampshire, and parts of New York, Massachusetts, and Connecticut (USFWS 2000).

The New England/Mid-Atlantic Coast region (BCR 30) overlaps a very small portion of the State in the extreme southeastern corner. BCR 30 encompasses the coastal areas of States ranging from southern Maine to Virginia. Of all the BCR in the United States, BCR 30 has the highest human population

densities. Much of the region was converted to agricultural production as human settlements in the region expanded, but today the region is dominated by forest and residential use (USFWS 2000).

Annual Harvest Estimate

The populations of most of the mammalian predators addressed in this EA are sufficient to allow for harvest seasons that typically occur during the fall and winter of each year. Hunting and trapping seasons in the State are established, enforced, and regulated by the MDIFW. The only mammalian species addressed in this EA that are not harvestable in the State during annual hunting and/or trapping seasons are feral and domestic cats, feral and domestic dogs, and eastern chipmunks. During the development of this EA, there was no closed season for hunting coyotes in the State. Coyotes can be taken at any time with no limit on the number that can be taken. Red fox, gray fox, raccoons, opossum, and striped skunks could be harvested in the State during annual hunting and trapping seasons, which allows an unlimited number of those species to be harvested during those seasons with no limit on the number that can be possessed during the season. Mink, long-tailed weasels, and short-tailed weasels could be harvested during annual trapping seasons with no limit on the number of animals of each species that could be harvested and possessed during the season. The MDIFW has developed species assessments that contain detailed population and harvest information for many of the species addressed in this EA that can also be harvested during annual hunting and/or trapping seasons[5]. The only bird species addressed in this EA that can currently be harvested during a hunting season is the American crow.

Issue 2 - Effects of Activities on the Populations of Non-target Wildlife

The issue of non-target species effects 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. If the magnitude of dispersal or lethal take was high, adverse effects could occur to non-target wildlife populations. Methods available for use under the alternatives are described in Appendix B.

Concerns have also been raised about the potential for adverse effects to occur to non-target wildlife from the use of registered pesticides and chemical methods. Registered pesticides being considered for use to reduce or prevent nest predation include large gas cartridges, the avicide DRC-1339, Avitrol®, and mesurol, which are further discussed in Appendix B. Chemical methods considered for use include CO_2, immobilizing drugs, and euthanasia chemicals.

Issue 3 – Effects of Activities on Threatened and Endangered Species

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)].

T&E species listed by the USFWS, the National Marine Fisheries Service, and the State of Maine were reviewed to identify potential effects on those species. For a complete list of federal and state listed T&E species, please see Appendix G and Appendix H. 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 and to facilitate interagency cooperation, WS

[5]Information on the species assessments can be accessed at http://www.maine.gov/ifw/wildlife/species/plans/mammals/.

consulted with the USFWS under Section 7 during the development of this EA, which is further discussed in Chapter 4.

Issue 4 - Effectiveness of Methods and Strategies for Alleviating Nest Predation Risks

Some concerns have been raised about the effectiveness of methods in reducing predation and increasing fecundity of native ground nesting bird species in coastal areas and on coastal islands of Maine to the desired population goals and objectives. In general, goals and objectives for piping plovers and roseate terns have been identified in the Federal Recovery Plans for those species (USFWS 1996, USFWS 1998) and the State assessments or management systems for each species. The state-specific goals and objectives for piping plovers, least terns, and roseate terns that have been adopted by the MDIFW are detailed in Appendix F. It is important to note that the efficacy of a specific predation management program cannot be evaluated by the same benchmarks outlined in recovery plans. Predation is only one source of mortality in waterbirds, and many other mortality sources, such as weather events or extreme high tides, are beyond the control of people. Therefore, predation management efforts should not be expected to guarantee fledging success, but should be viewed as a tool to help increase the number of fledglings in a given season. Ultimately, predation management is designed to reduce or eliminate nest and chick losses caused by predators, which is one-step in a process to meet state and federal recovery goals.

The effectiveness of any program could be defined in terms of losses or risks potentially reduced or prevented, whether practitioners accurately diagnosis the problem, the species responsible for the predation, and how actions are implemented to reduce risks of predation. To determine that effectiveness, WS and cooperating entities must be able to complete management actions expeditiously to minimize harm to non-target animals and the environment, while at the same time, using methods as humanely as possible within the limitations of funding and workforce. The most effective approach to resolving predation risks would be to use an adaptive integrated approach that 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[6]. 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 person using the method and, for WS' personnel, the guidance provided by WS' Directives and policies.

Issue 5 - Effects of Management Methods on Human Health and Safety

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

In addition to the potential risks to the public associated with methods, risks to employees are also an issue. Employees of the cooperating entities are potentially exposed to methods as well as subject to

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

workplace accidents. Methods available for use under the alternatives are considered chemical methods and non-chemical methods.

Safety of Registered Pesticides and Chemical Methods Employed

The issue of using chemical methods as part of managing predation risks 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 pesticides would be limited to large gas cartridges, Avitrol®, mesurol, and DRC-1339. Chemical methods that would be available would include CO_2 euthanasia, immobilizing drugs, and euthanasia chemicals. The issue of the potential for drugs used in animal capture, handling, and euthanasia to cause adverse health effects in humans that hunt and consume the species involved has been raised. Among the species addressed in the EA, this issue is expected to be of concern only for wildlife that are hunted and sometimes consumed by people as food. Chemicals posed for use under the relevant alternatives would be regulated by the EPA through the FIFRA, by State laws and regulations, by the MDABPC, by the Drug Enforcement Administration, by the FDA, and by WS' Directives. A list and description of chemical methods available for use under the alternatives can be found in Appendix B. Those methods will be discussed further in Chapter 4.

Safety of Non-Chemical Methods Employed

Non-chemical methods employed to reduce predation risks, if misused, could potentially be hazardous to human safety. Non-chemical methods are also discussed in Appendix B. The cooperator requesting assistance would be made aware through a MOU, cooperative service agreement, or a similar document that those devices agreed upon could potentially be used on property owned or managed by the cooperator to resolve nest predation.

Issue 6 - Effects on the Socio-cultural Elements of the Human Environment

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

The human attraction to animals has been well documented throughout history and started when humans began domesticating animals. The public share a similar bond with animals and/or wildlife in general and in modern societies, large percentages of households have indoor or outdoor pets. However, some people may consider individual wild animals as "*pets*" or exhibit affection toward those animals, especially people who enjoy viewing wildlife. Therefore, the public reaction can be variable and mixed to managing predation risks 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 include direct benefits related to consumptive and non-consumptive uses, indirect benefits derived from vicarious wildlife related experiences, and the personal enjoyment of knowing wildlife exists and contributes to the stability of natural ecosystems (Bishop 1987). Direct benefits are derived from a personal relationship with animals and may take the form of direct consumptive use (*e.g.*, using parts of or the entire animal) or non-consumptive use (*e.g.*, viewing the animal in nature or in a zoo, photographing) (Decker and Goff 1987).

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

Public attitudes toward wildlife vary considerably. Some people believe that all wildlife should be captured and translocated to another area to alleviate damage or threats to protected resources. Some people directly affected by the problems caused by wildlife strongly support removal of the animals causing damage. Individuals not directly affected by the harm or damage may be supportive, neutral, or totally opposed to any removal of wildlife from specific locations or sites. Some people totally opposed to managing damage caused by wildlife want WS to teach tolerance for damage and threats caused by wildlife, and that wildlife should never be killed. Some 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.

Some individuals are offended by the presence of overabundant mammal species, such as raccoons, or feral species, such as cats or dogs. To such people those species represent pests that are nuisances and upset the natural order in ecosystems, and that are carriers of diseases transmissible to humans or other wildlife. Their overall enjoyment of other animals is diminished by what they view as the destructive presence of such species. They are offended because they feel that those mammal species proliferate in such numbers and appear to remain unbalanced.

Issue 7 - Humaneness and Animal Welfare Concerns of Methods

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

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

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). 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.

The AVMA states "*...euthanasia is the act of inducing humane death in an animal*" and "*... the technique should minimize any stress and anxiety experienced by the animal prior to unconsciousness*" (Beaver et al. 2001). Some people would prefer AVMA accepted methods of euthanasia to be used when killing all animals, including wild animals. The AVMA states "[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 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, such as restraint in foothold traps or changes in the blood chemistry of trapped animals, indicate "*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 would involve trade-offs between the above aspects of pain and humaneness. Therefore, humaneness, in part, appears to be a person's perception of harm or pain inflicted on an animal, and people may perceive the humaneness of an action differently. The challenge in coping with this issue is how to achieve the least amount of animal suffering. The issue of humanness and animal welfare concerns will be further discussed in Chapter 4. SOPs to alleviate pain and suffering are discussed in Chapter 3.

Issue 8 - Effects of Nest Predator Management Activities on the Regulated Harvest of Those Species

Another issue commonly identified is a concern the removal of nest predators would affect the ability of persons to harvest those species during the regulated hunting and trapping seasons either by reducing local populations through the lethal removal of wildlife or by reducing the number of wildlife present in an area through dispersal techniques. Those species that are addressed in this EA that also can be hunted and/or trapped during regulated seasons in the State include red fox, gray fox, coyotes, raccoons, opossum, striped skunks, mink, weasels, and American crows. At the time this EA was developed, there was no closed hunting season for coyotes, which allows them to be taken throughout the year.

Non-lethal methods would be used to reduce or alleviate predation risks by dispersing target wildlife from areas where predation or the threat of predation was occurring. Similarly, lethal methods would be used to reduce predation risks associated with those wildlife species by lowering densities in areas where predation or the threat of predation was occurring, which could reduce the availability of those species during the regulated harvest season. Reducing the risk of nest predation would primarily be conducted in areas where hunting and trapping access was restricted or during periods in the year when hunting and trapping seasons were closed. The use of methods could disperse target wildlife from the area where predation or the risk of predation was occurring to areas outside the area, which could serve to move those species from those less accessible areas to places accessible to hunters or trappers.

Issue 9 - Effects on Recreation in Areas Where Nest Predation Management Activities Occur

Coastal beaches and islands are used for swimming, fishing, sunbathing, picnics, shell collecting, hunting, bird watching, trapping furbearers, walking pets, and other outdoor activities. Some people have expressed concerned that management activities would restrict recreation in those areas where nesting and efforts to reduce predation occur. This issue as it relates to each of the alternatives is also evaluated in Chapter 4 of this EA.

2.3 ISSUES CONSIDERED BUT NOT ANALYZED IN DETAIL WITH RATIONALE

Additional issues were also identified by WS, the MDIFW, and the USFWS during the scoping process of this EA. Those issues identified were considered during the development of this EA but will not be

analyzed in detail for the reason provided. The following issues were identified during the scoping process but those issues will not be analyzed in detail.

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

A concern was raised that an EA for an area as large as the nesting area of colonial waterbirds in the State would not meet the NEPA requirements for site specificity. Reducing nest predation risks falls within the category of federal or other regulatory agency actions in which the exact timing or location of individual activities cannot usually be predicted well enough ahead of time to accurately describe such locations or times in an EA or EIS. Although WS, the USFWS, and the MDIFW can predict some of the possible locations or types of situations where some risks of predation could occur, the program cannot predict the specific locations or times at which nest predation would occur. In addition, WS, the USFWS, and the MDIFW would not be able to prevent predation in all possible nesting areas without resorting to the removal of target wildlife 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, including those of the USFWS and the MDIFW.

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 actions may be categorically excluded from further evaluation under the NEPA (7 CFR 372.5(c)). The intent in developing this EA is to determine if the proposed action or the other alternatives would potentially have significant individual and/or cumulative impacts on the quality of the human environment that would warrant the preparation of an EIS. This EA provides a thorough analysis by analyzing the potential for individual and cumulative impacts.

In terms of considering cumulative effects, one EA analyzing impacts for nesting areas of plovers and terns 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 have a significant impact on the quality of the human environment, then an EIS would be prepared. Based on previous requests for assistance, activities associated with reducing nest predation risks in Maine would continue to occur in a very small area of the State where nest predation was occurring or likely to occur.

Impact on Biodiversity

The WS program and the USFWS do not attempt to eradicate any species of native wildlife in the State. WS and the USFWS operate in accordance with applicable federal, and State laws and regulations enacted to ensure species viability. Methods available would be employed to target individual animals or groups of animals identified as posing a threat of nest predation or feeding on the eggs, nestlings, and/or adults of ground nesting birds. Any reduction of the local number of animals is frequently temporary because immigration from adjacent areas or reproduction replaces the animals removed. Managing nest predation risks has previously occurred on a small percentage of the land area in Maine and would only target those nest predators identified as feeding on eggs, nestlings, and adults of ground nesting birds or posing a threat of predation. Therefore, impacts on biodiversity associated with reducing nest predation risks would not adversely affect biodiversity in the State.

A Loss Threshold Should Be Established Before Allowing Lethal Methods

One issue identified through WS' implementation of the NEPA processes is a concern that a threshold of loss should be established before employing lethal methods to resolve nest predation. The appropriate

level of allowed tolerance or threshold before employing lethal methods would differ among cooperators and nest predation situations. Establishing a threshold would be difficult or inappropriate to apply to T&E species protection because if some degree of predation were allowed, much of the potential benefit would be sacrificed before nest predator management was implemented.

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 determined a need for wildlife damage management could be established if a forest supervisor could 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.

Nest Predator Management Should Not Occur at Taxpayer Expense

An issue identified is the concern that alleviating predation risks should not be provided at the expense of the taxpayer or that activities should be fee-based. Funding for activities to reduce nest predation risks would be derived from federal appropriations and through cooperative funding. The Federal Aid in Wildlife Restoration Act (16 USC 669-669i; 50 Stat. 917) of 1937 provides Federal funding to States for management and restoration of wildlife through an 11% tax levied on sporting arms and ammunition. Several grant programs are available through the USFWS, Division of Sport Fisheries and Wildlife. One of these programs provides funding for the restoration of T&E species, which is specified within the ESA. In general, the primary federal funding that would support involvement would be derived from the sales of guns and ammunition, not from general tax revenue. Other grant options that may be used to support activities, such as State Wildlife Grants, would be general appropriated tax dollars, but this contribution would be minimal in proportion to other sources. Federal funding for nest predator management would not be the only mechanism in the future. Activities conducted in the State for the management of nest predation may also be funded through cooperative service agreements with individual property owners or associations, or through private grant opportunities. Therefore, funding for activities could be derived from other means beside taxpayer sources.

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 in reducing or preventing nest predation 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 nest predation under similar circumstance to be evaluated and applied if appropriate. Additionally, management operations may be constrained by cooperator funding and/or objectives and needs.

Risks of Nest Predation Should Be Managed By Private Entities

Private entities could be contacted to reduce nest predation for property owners or when deemed appropriate by the resource owner. Some property owners would prefer to use a private nuisance wildlife control agent because the nuisance wildlife agent is located in closer proximity and thus could provide the service at less expense, or because they prefer to use a private business rather than a government agency. However, some property owners would prefer to contract with a government agency. In particular, those persons seeking assistance may prefer to use WS because of security and safety issues. WS further clarifies interfacing with private business and establishing cooperative projects in WS Directive 3.101.

Effects from the Use of Lead Ammunition in Firearms

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

To reduce risks to human safety and property damage from bullets passing through wildlife, the use of rifles is applied in such a way (*e.g*., caliber, bullet weight, distance) to ensure the bullet does not pass through wildlife. Wildlife removed using rifles would be taken within areas where retrieval of all carcasses for proper disposal would be highly likely (*e.g.*, open grassy sites). With risks of lead exposure occurring primarily from ingestion of shot and bullet fragments, the retrieval and proper disposal of wildlife carcasses would greatly reduce the risk of scavengers ingesting or being exposed to lead.

However, deposition of lead into soil could occur if, during the use of a firearm, the projectile passes through the target, if misses occur, or if the carcass was 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 was 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 from runoff. Stansley et al. (1992) studied lead levels in water that was subjected directly to high concentrations of lead shot accumulation because of intensive target shooting at several shooting ranges. Lead did not appear to "*transport*" readily in surface water when soils were neutral or slightly alkaline in pH (*i.e*., not acidic), but lead did transport more readily under slightly acidic conditions. Although Stansley et al. (1992) detected elevated lead levels in water in a stream and a marsh that were in the shot "*fall zones*" at a shooting range, the study did not find higher lead levels in a lake into which the stream drained, except for one sample collected near a parking lot. Stansley et al. (1992) believed the lead contamination was due to runoff from the parking lot, and not from the shooting range areas. The study also indicated that even when lead shot was highly accumulated in areas with permanent water bodies present, the lead did not necessarily cause elevated lead contamination of water further downstream. Muscle samples from two species of fish collected in water bodies with high lead shot accumulations had lead levels that were well below the accepted threshold standard of safety for human consumption (Stansley et al. 1992).

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

WS' assistance with removing nest predators would not be additive to the environmental status quo since those wildlife species removed by WS using firearms could be lethally removed by other entities using the same method in the absence of WS' involvement if a permit for such activities was issued. The amount of lead deposited into the environment may be lowered by WS' involvement in reducing predation risks due to efforts by WS to ensure projectiles do not pass through but are contained within the carcass, which limits the amount of lead potentially deposited into soil from projectiles passing through the carcass. The proficiency training received by WS' employees in firearm use and accuracy increases the likelihood that wildlife would be lethally removed humanely in situations that ensure accuracy and that misses occur infrequently, which further reduces the potential for lead to be deposited in the soil from misses or from projectiles passing through carcasses. In addition, WS' involvement ensures carcasses lethally removed using firearms would be retrieved and disposed of properly to limit the availability of lead in the environment and ensures carcasses would be removed from the environment to prevent the ingestion of lead in carcasses by scavengers. Based on current information, the risks associated with lead bullets that were deposited into the environment from WS' activities due to misses, the bullet passing through the carcass, or from carcasses that may be irretrievable would be below any level that would pose any risk from exposure or significant contamination of water. As stated previously, when using shotguns, only non-toxic shot would be used by WS as defined in 50 CFR 20.21(j).

Impacts of Dispersing Wildlife to other Areas

Another issue often raised is that the dispersal of wildlife from one location to reduce predation risks can result in new predation risks at another location or result in higher risks of damage occurring to property, agricultural resources, other natural resources, and threats to human safety. While the predation risk at the original location may be resolved by dispersing target wildlife, the recipient of the predators may see the problem as imposed on them. Thus, overall, there is no resolution to the original problem. Nest predators are usually prevented from accessing nests using exclusion. If nest predators were prevented from accessing a food resource, such as eggs or fledglings, those predators could disperse to other areas where food sources were available and easier to obtain. WS and the USFWS have attempted to minimize the impact of dispersing wildlife by creating a management option that could reduce the number of wildlife using locations that were responsible for creating the conflict.

A Site Specific Analysis Should be Made for Every Location Where Activities 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. The 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 would 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 potential impacts for areas where nesting could occur would provide a more comprehensive and less redundant analysis than multiple EAs covering smaller areas. One EA also allows for a better cumulative impact analysis. If a determination were made through this EA that the proposed action could have a significant impact on the quality of the human environment, then an EIS would be prepared.

Inability to Know if an Individual of a Given Wildlife Species is Actually a Nest Predator

The need for action is to reduce risks of predation associated with those target species that are addressed in this EA. The target species have been carefully identified through an evaluation of their ability to prey on eggs, chicks, fledglings, or adults of ground nesting bird species. Not all of the target species pose a risk of predation during all of the nesting stages of ground nesting birds (*e.g.*, eggs are not consumed by raptor species but nestlings and adults could be consumed), but are nonetheless still a threat to the successful recruitment of young birds into the population. For the purpose of this EA, the analyses evaluate the potential biological impacts to each targeted species based on the total take of individuals from the specified areas. In addition, take is not based on the determination of whether an individual has actually preyed on the protected resource, but is dependent on where those individual predators are located. The objective is to reduce predation risks and not necessarily initiate activities after predation has already occurred since predation events can result in the loss of numerous eggs and/or nestlings or could result in the abandonment of nesting areas by ground nesting species. In many situations, the goal would be to target individuals of each species in a given area adjacent to the nesting areas of the protected resources to reduce the risk of predation actually occurring.

Effects on Local Economies in Areas Where Activities are Conducted

Millions of people come to the Maine coast to engage in outdoor related activities, most notably beach going, but bird watching is also a popular recreational activity pursued by seasonal visitors. The RCNWR and cooperative land encompasses 14,383 acres and hosts approximately 250,000 refuge visitors each year who are rewarded with opportunities for wildlife-dependent public uses, especially in wildlife observation and photography, environmental education, interpretation, fishing, and hunting (USFWS 2011*b*). In addition to Refuge properties, other areas are also available for public access, which offer additional bird-watching opportunities. Collectively, these visitors contribute dollars into the local economy at restaurants, motels, and local businesses. These people would be positively affected by an increase in bird species abundance and diversity. Positive effects on the protected bird species would be expected to result in additional people engaging in bird-watching opportunities and additional dollars infused into the local economy.

Animals Should Not Be Killed For Engaging In Natural Behaviors

Many people do not agree with killing animals to reduce nest predation. Some people may feel that killing an animal is justified based on the reasons for doing so. Still, some people cannot justify killing an animal when it is only behaving naturally. WS and the USFWS recognize that these are valid concerns, and that the public views the killing of wildlife in various ways. Wildlife managers routinely consider the biological implications whenever management strategies are considered, and managing T&E species is no different. Piping plovers, least terns, and roseate terns have all been directly affected by habitat fragmentation and human disturbance, which have been the primary reasons for population declines and listing status (McCollough 1993, USFWS 1996, USFWS 1998). For these same reasons, other species populations have flourished, and the role of predatory mammals and trophic cascades and their effects on avian diversity in fragmented habitats have been revealed (Erwin et al. 2001). Although predation may appear to be a natural behavior, the predation is often a function of faunal and landscape changes caused by humans, which has negatively affected the relationships between predators and prey (Reynolds and Tapper 1996). Many of the species that would be targeted, especially raccoons, skunks, and red fox have the ability to suppress reproduction of coastal waterbirds. To reverse this trend, wildlife managers must take corrective action that best suits the needs of the resource while taking precautions to not affect the biological integrity of the ecosystems, and this EA serves to identify those means.

Education and Information Efforts Need to Increase

During the scoping process for the development of this EA, various suggestions relative to the promotion of education and information were offered to lessen predation effects to protected waterbirds. These comments specifically included keeping pet cats indoors, proper garbage disposal, excluding wildlife from outbuildings, regulating the feeding of birds, placing signs to decrease the feeding of gulls, and decreasing dog presence on beaches. WS, the USFWS, and the MDIFW recognize the importance of all these forms of education and information. In fact, much effort and expense is invested each year to address many of these suggestions. The MDIFW, the USFWS, and the Maine Audubon employs outreach professionals, as well as interns each summer to disseminate information to increase the awareness of nesting waterbirds in an attempt to reduce all the negative behaviors of people that affect nesting success. Biologists have routinely sent letters to property owners and real estate companies (rentals), made personal visits to cat owners, maintained educational booths on area beaches, worked to increase the capacity of law enforcement, and facilitated beach management agreements with municipalities. The monitoring and recovery efforts of these rare birds have included a high degree of public outreach and these efforts are not expected to decline in the future.

Predators are Targeted too far from Nesting Grounds

A comment that was received from the public included the criticism that target species were being taken beyond a reasonable distance from the nesting areas. WS and the USFWS are very sensitive to the issue of taking more individuals than would be necessary. As previously discussed in this section, WS and the USFWS have to contend with the inability to determine whether each individual of a species will cause predation. In the same context, WS and the USFWS are unable to assure that animals that occupy areas away from the nesting grounds will not travel to the nesting areas for foraging opportunities. In general, WS would conduct work when requested in areas based on several criteria: the size of a target species home range, the presence of target species, and the land ownership of adjacent properties. Each nesting area has unique landscape and anthropomorphic features that ultimately dictate the areas and distance where nest predators would be targeted. A home range of an animal is defined as the extent of an area with a defined probability of occurrence of an animal during a specified period (Kernohan et al. 2001). While no standard distance is used in determining where to conduct predator management activities, WS considers the target species, their perceived home range size (many species' home ranges can vary greatly by region, time of year, and availability of resources), and the general likelihood that animals in adjacent habitats could become nest predators. WS and the USFWS would always attempt to focus efforts as close as possible to nesting areas, but could also conduct activities at greater distances when landscape features and property access are suitable. In ideal situations, WS and the USFWS would attempt to surround nesting areas as closely as possible, but when immediate landowners do not allow access, or other prohibitive conditions were present, the area becomes enlarged. Finally, wide-ranging species like coyotes and red fox are more likely to be targeted off-site than species like raccoons and skunks, based upon the size of their home range.

Removing Predators Causes an Increase in Small Mammal Populations

Citizens that live in close proximity to nesting areas have raised the concern that removing predators in these areas may cause increases in the abundance of small mammals such as mice, voles, squirrels, and chipmunks. While this is a valid concern, WS and cooperators believe that small mammal abundance is not likely to be influenced by seasonal, selective removal of nest predators. The changes in the population size of small mammals would more likely be caused by weather and food availability. In general, small mammal species have a high reproductive potential that is independent of predator presence. There is likely to be a surplus of these animals despite the degree of predation, and factors such as disease are more likely to control large populations. In addition, as stated previously in this EA, nest

predator management would be limited in duration and scale. WS and the USFWS would focus efforts in small areas for short periods (3 to 4 months) and not all predators would be removed from the immediate area. Once management efforts cease, it would be likely that new predators would colonize these areas and feed on small mammals. Species such as coyotes and red fox would be likely to colonize vacant territories during dispersal periods in the fall. Furthermore, not all target species are known to forage on small mammals. While coyotes and fox often do prey on small mammals, other nest predators like raccoons and skunks are unlikely to do so. Finally, many species that could be targeted, such as mink and weasels, would not be present in some of the nesting areas, or if they were, would only be present in low numbers, so their ability to regulate small mammal populations would be limited.

Removing Nest Predators in Summer Causes Orphaning of Young

The public has expressed concerns about the orphaning of wildlife when adult females were killed to alleviate nest predation risks. WS and the USFWS considered this concern and investigated the frequency of these events. During the 2011 nesting season, WS killed 62 raccoons, five of which were lactating females (8%), and they were taken from three different locations. Also in 2011, WS killed 18 red fox, of which only one (5.5%) was a lactating female (WS, unpublished data). In fox, the raising of young is a shared responsibility between males and females, which likely results in the young fox surviving at a much younger age if the male is present. During the 2008 season, WS killed a lactating female red fox on April 2, and the litter was confirmed to have survived when they were observed on May 13.

Based on information gathered by WS during previous activities to address nest predation, lactating females would not be commonly captured during activities to reduce nest predation risks. Adult females often exhibit restricted movements during the rearing of young. Unfortunately, lactating females can also be nest predators. If activities were not conducted during those times when lactating females could be present in nesting areas, predation may still occur; therefore, the need for action would not be met.

These examples indicate that different species have independent life histories that influence the survival of young animals, but it appears orphaning of neonates does not occur in high frequency. In order to meet recovery goals of plovers and terns, WS and the USFWS believe it is still necessary to conduct management efforts during the nesting season despite the negative and unfortunate consequences of removing lactating females.

Baiting of Traps Attracts Predators to Nesting Areas

A concern was raised that trapping efforts would be counter-productive to the objective of reducing predation risk because trapping attracts predators to nesting areas. It was expressed that the baiting of traps provided alternative food sources that would attract new predators to bird nesting areas.

The detection rate of baits and lures by predators that would be used at trap sites is likely variable. WS would attempt to conduct activities as close as possible to nesting areas. On occasion, efforts could be conducted as much as one kilometer away from nesting locations. The detectability of bait and scents that would be used to attract animals to traps would be dependent upon many variables (*e.g.*, species, wind, humidity, habitat). Generally, baits and lures would not be used in such quantities that would attract higher densities of nest predators. The baiting of traps and the use of lures would not likely attract predators because the amount of bait and lure used would be minimal.

During supplementing feeding evaluations to reduce nest predation on waterfowl by providing predators with additional food sources, several studies indicated that supplemental feeding of predators did not reduce predation and predation rates on waterfowl nests were similar to areas where supplemental feeding

did not occur (Greenwood et al. 1998, Cooper and Ginnett 2000, Conover et al. 2005). Those studies also provide an indication that when a supplemental food sources was provided, additional predators were not attracted to the area to feed since predation rates on nests were similar to areas where supplemental feeding did not occur. If additional predators were attracted to the supplemental food source, it would be expected that predation on nests would also likely increase since more predators would be attracted to the area and would likely find nests. The rates of predation on ground nesting bird eggs increase when predator density and diversity increase (Lariviere 2004). However, predation rates on nests were similar (*i.e.*, no statistically significant increase or decrease occurred) in previous supplemental feeding evaluations of waterfowl nest predation (Greenwood et al. 1998, Cooper and Ginnett 2000, Conover et al. 2005). In addition, those studies were providing large quantities of supplemental food that would exceed the amount of bait or lure that could used to draw predators to traps. Therefore, the use of limited amounts of bait and/or lures at trap sites would not likely attract additional predators to an area. Subsequently, the use of baits or lures would not increase or decrease predation rates in those areas where traps were baited or lures were used.

Habitat Loss from the Growing Human Population Not Nest Predation is the Cause of Declines

A concern was raised about human population growth and the resulting wildlife habitat loss and fragmentation that it often causes. Human populations have expanded and land has been transformed to meet varying human needs. As the landscape has been altered to meet human needs, wildlife habitat has been substantially changed. Those human needs often compete with wildlife. It is well documented that habitat degradation, manipulation, and loss has been the major cause that led to the population declines of piping plovers and least terns (McCollough 1993, USFWS 1996, McCollough 2000). Habitat management and preservation is often paramount in T&E species recovery programs. Recovery efforts for piping plovers, least terns, and roseate terns are no different, and extensive progress has been made to acquire, protect, or preserve the habitats in which these species exist. Furthermore, the ESA has specific language and provisions to preserve T&E species habitat.

Wildlife management in modern environments has to contend with the inheritance of faunal and landscape changes caused by humans, which affect the relationships between predators and prey (Reynolds and Tapper 1996). Predation is one of many mortality factors that influence wildlife populations. Bird populations may be regulated by density dependent and independent factors including food supply, territorial space, nesting sites, predation, and parasites (Cote and Sutherland 1997). Predators often play critical roles in the composition and function of wildlife populations in ecosystems (Witmer et al. 1996). Normally, predation would be considered part of the function of a healthy ecosystem. However, changes have occurred in the ecosystem that encompasses the coastal region of Maine that have resulted in the loss and fragmentation of available nesting habitat for ground nesting colonial waterbirds. Declines in bird populations associated with habitat loss and fragmentation may be compounded by predation (Cote and Sutherland 1997). The effects of predation on birds can be detrimental to local populations; especially, when predator densities are high or when predators gain access to areas not historically occupied (Stoudt 1982, Bailey 1993). In general, ground nesting birds suffer the highest predation rates (DeVos and Smith 1995).

The removal of predators has been conducted to increase survival of fledglings and to increase breeding populations of threatened or endangered wildlife, rare species, and species not traditionally hunted (Reynolds and Tapper 1996). Increased rates of nest predation are believed to be largely related to habitat fragmentation, habitat degradation, and other changes in related landscape features (Heske et al. 2001, Nelson 2001, Sovada et al. 2001). The impacts of predation vary geographically because of habitat composition and structure along with species composition of predator communities (Nelson 2001, Sovada et al. 2001).

Cote and Sutherland (1997) showed predator removal benefited nesting bird populations by increasing the number of breeding individuals. Predator removal can be an important management activity necessary to maintain some bird populations because nest predation accounts for the largest reason for nest failures in most species of songbirds (Martin 1992) and rates of nest predation can be so great that some local populations cannot be self-sustaining and have been labeled population sinks (Pulliam 1988, Brawn and Robinson 1996). Predator removal can reduce early avian mortality on eggs and chicks (Cote and Sutherland 1997). Similarly, post-breeding population sizes are often larger following the removal of predators. However, predator removal does not necessarily affect bird breeding population sizes to the same extent. Predator removal studies that examine the benefit of breeding bird populations are not consistent in their results, with some studies showing increased breeding populations; whereas, other studies show no effect or decreases (Cote and Sutherland 1997). These results are not unexpected given how bird populations are regulated (Cote and Sutherland 1997).

Factors limiting the productivity of roseate terns indentified in the current revision of the roseate tern recovery plan were the concentration of terns into a few large breeding colonies caused by a loss of nesting sites and predation (USFWS 1998). The loss of nesting sites was attributed to erosion and competition with herring and great black-backed gulls. The loss of nesting sites concentrated terns onto islands close to or on the mainland, which are more accessible to predators (USFWS 1998). The piping plover recovery plan identified predation "*...as a major factor limiting piping plover reproductive success at many Atlantic Coast sites*" (USFWS 1996). Although the loss and degradation of habitat has been major contributors to the decline of plovers and terns, predation has also been identified as a limiting factor in the successful recovery of plovers and terns (USFWS 1996, USFWS 1998).

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). Detailed environmental impacts analyses of the alternatives will occur in Chapter 4 (Environmental Consequences). Chapter 3 also discusses alternatives considered but not analyzed in detail, with rationale. SOPs that would be incorporated into the appropriate alternatives 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 nest predation of ground nesting waterbirds in the State:

Alternative 1 – No Involvement by WS in Managing Predation Risks

This alternative precludes all activities by WS to reduce predation risks. WS would not be involved with any aspect of nest predator management in the State. All requests for assistance received by WS to reduce nest predation risks would be referred to the USFWS, the MDIFW, and/or private entities. This alternative would not deny other federal, State, and/or local agencies, including private entities from conducting activities directed at reducing predation risks in the State. Many of the methods listed in Appendix B would be available for use by other agencies and private entities, unless otherwise noted in this EA, to manage predation risks.

Under this alternative, property owners/managers may have difficulty obtaining depredation permits to lethally remove avian predators. The USFWS needs professional recommendations on individual predation situations before issuing a depredation permit for lethal take, and the USFWS does not have the mandate or the resources to conduct activities to verify and gather information relating to each predation

situation before issuing a depredation permit. 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 those procedures described in Alternative 3.

Despite no involvement by WS in resolving predation and threats of predation in the State, other entities could continue to reduce predation risks by employing those methods legally available since the take of nest predators could occur despite the lack of involvement by WS. The take of nest predators could occur through the issuance of depredation permits by the USFWS and/or the MDIFW, during the hunting and/or trapping seasons, or under the depredation order for blackbirds without the need for a depredation permit issued by the USFWS. All methods described in Appendix B would be available for use to reduce predation risks, except for the use of DRC-1339 and mesurol, which can only be used by WS. Immobilizing drugs and euthanasia chemicals could only be used by WS or appropriately licensed veterinarians.

Therefore, under this alternative, entities seeking assistance with addressing predation risks could contact WS but WS would immediately refer the requester to other entities. The requester could then contact other entities for information and assistance with managing predation risks, could take actions to alleviate predation without contacting any entity, or could take no further action.

Alternative 2 – Managing Nest Predation Risks 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 entities requesting assistance with information, demonstrations, and recommendations on available and appropriate methods available. The implementation of methods and techniques to reduce nest predation would be the responsibility of the requester with no direct involvement by WS. In some cases, WS may provide supplies or materials that are of limited availability for use (*e.g.*, loaning of cage traps).

The WS program regularly provides technical assistance to individuals, organizations, and other federal, State, and local government agencies for managing wildlife damage. Technical assistance includes collecting information about the species involved, the nature and extent of the damage, and previous methods that the cooperator has attempted to resolve the problem. WS then provides information on appropriate methods that the cooperator may consider to resolve predation risks 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 reducing predation risks; those strategies would be 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 reduce nest predation in the State, except for mesurol and DRC-1339. Immobilizing drugs and euthanasia chemicals would only be available to WS or appropriately licensed veterinarians.

Those entities seeking assistance with reducing nest predation 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 nest predators from the USFWS and/or the MDIFW, when a permit was required. WS could evaluate the

predation risks and complete a Migratory Bird Damage Report, which would include information on the extent of the risks, the number of birds present, and a recommendation for the number of birds that should be taken to best alleviate predation risks. 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 operational assistance on the resource owner, other governmental agencies, and/or private businesses. Those entities could take action using those methods legally available to resolve or prevent nest predation as permitted by federal, State, and local laws and regulations or those persons could take no action.

Alternative 3 - Continuing the Current Integrated Approach to Managing Nest Predation (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 (see Appendix J; Slate et al. 1992), to reduce nest predation in Maine. The proposed action alternative would also continue those activities under the proposed action alternative selected during the development of the statewide gull damage management EA (USDA 2010). A major goal of the proposed action alternative would be to resolve and prevent the predation of plover and tern eggs, nestlings, and adults, when requested. To meet this goal, WS would continue to respond to requests for assistance with, at a minimum, technical assistance, or when funding was available, direct operational assistance. Funding could occur through federal appropriations or from cooperative funding. The adaptive approach to managing nest predation would integrate the use of the most practical and effective methods to resolve a request for assistance as determined by site-specific evaluation using the WS Decision Model.

Those entities requesting assistance would be provided with information regarding the use of appropriate non-lethal and lethal techniques. Preference would be given to non-lethal methods when practical and effective under this alternative (see WS Directive 2.101). Property owners or managers may choose to implement WS' recommendations on their own (*i.e*., technical assistance), use contractual services of private businesses, use volunteer services of private organizations, use the services of WS (*i.e*., direct operational assistance), take the management action themselves, or take no further action.

WS would work with those entities requesting assistance in addressing those nest predators responsible for predation as expeditiously as possible. To be most effective, activities should begin prior to the arrival of ground nesting waterbirds. Nest predation that has been ongoing can be difficult to resolve using available methods since those nest predators have been conditioned to an area and are familiar with a particular location. Subsequently, making that area unattractive using available methods can be difficult to achieve once predation has been ongoing and those nest predators have associated an area with a food source. WS would work closely with those entities requesting assistance to identify situations where nest predation could occur and begin to implement activities under this alternative as early as possible to increase the likelihood of those methods achieving the level of reduction in nest predation viewed as acceptable by the cooperating entity.

When WS receives a request for direct operational assistance, WS would conduct site visits to assess predation or threats, 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 resolve or prevent predation (see Appendix J). WS' personnel would assess the predation event or the risk of predation 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 predation. 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 predation or the risk of predation, the need for further management would be ended. In terms of the WS Decision Model, most efforts consist of continuous feedback between receiving the request and monitoring the results of the strategy to alleviate or prevent predation. 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.

Non-lethal methods would include, but would not be limited to minor habitat modification, visual deterrents, pyrotechnics, live traps, exclusionary devices, frightening devices, mesurol, Avitrol®, immobilizing drugs, foothold traps, cable restraints, translocation, and nest/egg destruction (see Appendix B for a complete list and description of potential methods). Lethal methods considered by WS would include live-capture followed by euthanasia, euthanasia chemicals, the recommendation of take during hunting and/or trapping seasons, shooting, large gas cartridges, and the use of DRC-1339. Euthanasia of live-captured target species would occur pursuant to WS Directive 2.505. Under the proposed action alternative, the most appropriate response would often be a combination of non-lethal and lethal methods, or there could be instances where application of non-lethal or lethal methods alone would be the most appropriate strategy. For any management methods employed, the proper timing would be essential in effectively reducing the number of nest predators present in areas where nesting occurs. Employing methods before nest building or soon after nest building would increase the likelihood that those removal and dispersal activities would achieve success. Therefore, coordination and timing of methods would be necessary to be effective in achieving expedient resolution of nest predation.

Non-lethal methods can disperse or otherwise make an area unattractive to nest predators; thereby, reducing the presence of those species at the site and potentially the immediate area around the site where non-lethal methods were employed. Non-lethal methods would be given priority when addressing requests for assistance (WS Directive 2.101). However, non-lethal methods would not necessarily be employed to resolve every request for assistance if deemed inappropriate by WS' personnel using the WS Decision Model. Non-lethal methods would be used to exclude, harass, and disperse target wildlife from areas where predation or threats were occurring. When effective, non-lethal methods would disperse nest predators from the area resulting in the reduced presence of those species at the site where those methods were employed. In addition, live-traps could be used to capture target wildlife.

Under the proposed action alternative, WS could employ only non-lethal methods when determined to be appropriate to alleviate nest predation by using the WS Decision Model. In many situations, either the cooperating entity would have tried to employ non-lethal methods to resolve predation and had been unsuccessful or the reduction in predation or threats had not reached a level that was tolerable by the requesting entity. In those situations, WS could employ other non-lethal methods, attempt to apply the same non-lethal methods, or employ lethal methods. In many situations, the implementation of non-lethal methods, such as exclusion-type barriers, would be the responsibility of the requester, which means that, in those situations, WS only function could be to implement lethal methods, if determined to be appropriate using the WS Decision Model.

The WS Decision Model is designed to be flexible, allowing a variety of methods to be used concurrently and in succession. The third step of the WS Decision Model deals with the evaluation of the potential management methods. Methods would be evaluated in the context of their legal and administrative availability and their acceptability based on biological, environmental, social, and cultural factors. In this process, WS includes public sentiment or concern in the decision-making process so lethal or non-lethal methods could be used as dictated by a cooperating entity or landowner. It is possible under Alternative 3

that lethal methods and non-lethal methods (*e.g*. translocation) could be used concurrently depending on land ownership.

Lethal methods could be employed to resolve predation associated with those nest predators identified by WS as predating on eggs, nestlings, or adults or posing as threats of predation under this alternative; however, WS would only employ lethal methods after receiving a request for the use of those methods. Lethal methods would often be employed to reinforce non-lethal methods and to remove those nest predators that were identified as predating nests or posing a risk of predation. The use of lethal methods could result in local population reductions in the area where predation or threats were occurring since individuals of a species would be removed from the population. The number of individuals removed from the population using lethal methods under the proposed action would be dependent on the number of requests for assistance received, the number of individuals involved with the associated predation or threat, and the efficacy of methods employed.

WS may recommend nest predators be harvested during the regulated hunting or trapping season for those species in an attempt to reduce the number of those species in the area where nesting occurs or could occur. Establishing hunting or trapping seasons and the allowed take during those seasons would be the responsibility of the MDIFW. WS does not have the authority to establish hunting/trapping seasons or to set allowed harvest numbers during those seasons.

A complete list of chemical and non-chemical methods available for use under the identified alternatives can be found in Appendix B. However, listing methods neither implies that all methods would be used by WS to resolve requests for assistance nor does the listing of methods imply that all methods would be used to resolve every request for assistance. As part of an integrated approach, WS could provide technical assistance and/or direct operational assistance when requested.

Technical assistance would occur as described in Alternative 2 of this EA. Direct operational assistance would include activities that were directly conducted by or supervised by personnel of WS. Operational assistance could be initiated when the problem could not be effectively resolved through technical assistance alone and there was a written MOU, cooperative service agreement, or other comparable document signed between WS and the entity requesting assistance. The initial investigation by WS' personnel into the requests for assistance would define the nature, history, and extent of the predation; species responsible for predation; and methods available to resolve the predation.

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

The National Wildlife Research Center (NWRC) functions as the research unit of WS by providing scientific information and the development of methods for wildlife damage management, which are effective and environmentally responsible. Research biologists with the NWRC work closely with wildlife managers, researchers, and others to develop and evaluate methods and techniques for managing wildlife damage. 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 4 – Managing Nest Predation Using Non-lethal Methods Only

Under this alternative, WS would be required to implement only non-lethal methods to resolve nest predation. Only those methods discussed in Appendix B that are considered non-lethal would be employed or recommended by WS. No lethal take of nest predators would occur by WS. The use of lethal methods could continue under this alternative by landowners or resource managers of areas where nest predation occurred. The non-lethal methods used or recommended by WS under this alternative would be identical to those identified in any of the alternatives.

In situations where non-lethal methods were impractical or ineffective to alleviate predation risks, WS could refer requests for information regarding lethal methods to the MDIFW, the USFWS, local animal control agencies, or private businesses or organizations. However, property owners/managers might be limited to using non-lethal methods only.

Under this alternative, non-lethal methods would include fencing, netting, deterrents/repellents, pyrotechnics, visual deterrents, exclusion, harassment, minor habitat alteration, cage traps, foothold traps, cable restraints, and translocation. If WS were to conduct operational assistance, nest predators live-captured would be translocated because lethal methods would be unavailable. The chemical repellent mesurol and the chemical frightening agent Avitrol® would also be available for use by WS under this alternative. Appendix B describes a number of non-lethal methods available for recommendation and use by WS under this alternative. WS would recommend an integrated approach to resolving requests for assistance under this alternative using those non-lethal methods available. WS would continue to provide technical assistance and direct operational assistance, when requested. Those activities described in Alternative 3, except for the recommendation and/or use of lethal methods, would continue to be available under this alternative. Property owners or managers could still resort to legal lethal methods or other methods not recommended by WS, use the services of other entities that were available to them, or take no action.

3.2 ALTERNATIVES CONSIDERED BUT NOT ANALYZED IN DETAIL WITH RATIONALE

Several additional alternatives were identified by WS and the USFWS; however, those alternatives will not be analyzed in detail. Those alternatives considered but not analyzed in detail include:

Non-lethal Methods Implemented 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 nest predation. If the use of non-lethal methods failed to resolve predation in each situation, lethal methods would be employed to resolve the request. Non-lethal methods would be applied to every request for assistance regardless of severity or intensity of predation or threat until deemed inadequate to resolve the request. This alternative would not prevent the use of lethal methods by those entities where nest predation has occurred on their property or the use of lethal methods by other entities on their property.

Those entities seeking assistance from WS often employ non-lethal methods to reduce predation risks 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 would be necessary before the initiation of lethal methods. Thus, only the presence or absence of non-lethal methods could be evaluated. The proposed action (Alternative 3) is similar to a non-lethal before lethal alternative because the use of non-lethal methods would be considered before lethal methods by WS (WS Directive 2.101). Adding a non-lethal before

lethal alternative and the associated analysis would not add additional information to the analyses in the EA.

Use of Lethal Methods Only by WS

This alternative would require the use of lethal methods only to reduce nest predation and threats of predation. However, non-lethal methods can be effective in preventing nest predation in certain instances. Under WS Directive 2.101, WS must consider the use of non-lethal methods before lethal methods. Non-lethal methods have been effective in alleviating nest predation, especially exclusion fences placed around ground nests. In those situations where nest predation risks 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 Nest Predators Only

Under this alternative, all requests for assistance would be addressed using live-capture methods or the recommendation of live-capture methods. Nest predators would be live-captured in live-traps, cable restraints, and foothold traps. All nest predators live-captured through direct operational assistance provided by WS would be translocated. Translocation sites would be identified and have to be approved by the MDIFW, the USFWS, and/or the property owner where the translocated nest predators would be placed prior to live-capture and translocation. Live-capture and translocation could be conducted by WS as part of the alternatives analyzed in detail, except the no involvement by WS alternative (Alternative 1) and the technical assistance only alternative (Alternative 2). However, WS could recommend the translocation of nest predators under Alternative 2 and other entities could translocate nest predators under Alternative 1. The translocation of nest predators could only occur under the authority of the MDIFW and in the case of birds, the USFWS. Therefore, the translocation of nest predators by WS would only occur as directed by those agencies. Since WS does not have the authority to translocate nest predators in the State unless permitted by the MDIFW and/or the USFWS, this alternative as a basis for addressing all nest predators was not considered in detail. In addition, the translocation of nest predators or the recommendation of translocation could occur under any of the alternatives analyzed in detail, except Alternative 1. However, translocation could occur by other entities under Alternative 1 despite no involvement by WS. For example, under the proposed action alternative, WS could translocate several raptor species that could be identified as nest predators.

The translocation of nest predators to other areas following live-capture would not generally be effective or cost-effective. Translocation is generally ineffective because nest predators are highly mobile and can easily return to sites from long distances, habitats in other areas are generally already occupied, and translocation would most likely result in damage problems occurring at the new location. In addition, dozens of nest predators would need to be captured and translocated to alleviate predation in some areas; therefore, translocation would be unrealistic. Translocation of wildlife is also discouraged by WS policy (WS Directive 2.501) because of the stress to the translocated animal, poor survival rates, and the difficulties that translocated wildlife have with adapting to new locations or habitats (Nielsen 1988). The translocation of wildlife can also raise concerns of spreading diseases by moving diseased wildlife from one area to an area where the disease is not prevalent.

Documentation exists that live-capturing and translocating wildlife away from nesting areas has negative consequences including disease transmission, stress, mortality of translocated animals, impacts on resident animals at or near release sites, and creating additional damage in release areas (Craven et al. 1998). In addition, the policy of the MDIFW restricts the translocation of red fox, raccoons, and striped skunks to less than five miles, so those species captured by WS would not be released beyond five miles of where those individuals were live-captured (MDIFW Administrative Policy J1.6).

Reducing Nest Predation Risks by Managing Nest Predator Populations through the Use of Reproductive Inhibitors

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

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

Population modeling indicates that reproductive control is more efficient than lethal control only for some rodent and small bird species with high reproductive rates and low survival rates (Dolbeer 1998). Additionally, the need to treat a sufficiently large number of target animals, multiple treatments, and population dynamics of free-ranging populations place considerable logistic and economic constraints on the adoption of reproduction control technologies as a wildlife management tool for some species. Currently, no chemical reproductive inhibitors are available for use to manage target wildlife populations. Given the costs associated with live-capturing and performing sterilization procedures on nest predators and the lack of availability of chemical reproductive inhibitors for the management of most wildlife populations, this alternative was not evaluated in detail. If a reproductive inhibitor became available to manage a large number of wildlife populations and if the inhibitor had been proven effective in reducing localized populations, the use of the inhibitor could be evaluated under the alternatives as a method available that could be employed or recommended. This EA would be reviewed and supplemented to the degree necessary to evaluate the use of the reproductive inhibitor as part of an integrated approach described under the proposed action and the other alternatives.

Short Term Eradication and Long Term Population Suppression

An eradication alternative would direct all the efforts of WS and the USFWS toward total long-term elimination of nest predator populations on property where plover and terns nest or could nest. Eradication of native wildlife species is not a desired population management goal of federal and state agencies or WS. Eradication as a general strategy for managing predation would not be considered in detail because all state and federal agencies with interest in, or jurisdiction over, wildlife oppose eradication of any native wildlife species and eradication is not acceptable to most people.

Suppression would direct the efforts of WS and the USFWS toward managed reduction of certain problem populations or groups. In addition, suppressing nest predator populations in all possible nesting areas would require the intensive reduction 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, including those of the USFWS and the MDIFW. It is not realistic or practical

to consider large-scale population suppression as the basis of a program to reduce nest predation. Problems with the concept of suppression are similar to those described above for eradication. Typically, activities in the State would be conducted on a very small portion of the sites or areas inhabited or frequented by problem species.

Bounties

Payment of funds (bounties) for killing nest predators has not been supported by State agencies as well as most wildlife professionals for many years (Latham 1960, Hoagland 1993). WS concurs with those agencies and wildlife professionals because of several inherent drawbacks and inadequacies in the payment of bounties. Bounties would often be ineffective at reducing nest predation over a wide area. The circumstances surrounding the take of animals are typically arbitrary and completely unregulated because it is difficult or impossible to assure animals claimed for bounty were not taken from outside the area where nest predation was occurring. In addition, WS and the USFWS do not have the authority to establish a bounty program.

Use of an Integrated Approach using Non-lethal, Non-chemical Methods Only (No Chemical Methods)

An alternative that uses only non-lethal, non-chemical methods would not likely be efficacious. This alternative would be similar to an alternative that uses translocation as the primary mechanism to prevent nest predation (as described above). As previously indicated, there are many negative ecological consequences with a translocation-only alternative. In contrast to the translocation-only alternative, this alternative would integrate other non-lethal methods, but only those that were non-chemical. This alternative would limit the total available methods. Many non-lethal, non-chemical methods (such as visual and auditory deterrents) are poor options and are restricted for use by the USFWS and the MDIFW because of the potential to scare the protected waterbirds. Due to the limitation in available techniques, this alternative was not considered in detail.

Use of Supplemental Feeding of Nest Predators to Reduce Nest Predation

Supplemental feeding of wildlife is a controversial topic among wildlife professionals and the public alike (Dunkley and Cattet 2003) and is often a factor in disease transmission in some species (Miller et al. 2003). Many other negative ecological and social effects may be caused by wildlife feeding including changes in reproductive success, mortality rates, human safety, and human-wildlife conflicts (Dunkley and Cattet 2003). In some instances, using supplemental food sources did not result in a reduction in nest predation (Greenwood et al. 1998, Cooper and Ginnett 2000, Conover et al. 2005). An alternative that uses supplemental feeding could actually have greater negative consequences to ecological processes than a no action alternative; therefore, this alternative was not considered in detail.

Manage Human Population Growth and Expansion

Neither WS nor the USFWS have statutory authority to become engaged in controlling human population growth. Furthermore, WS does not have regulatory authority with wildlife issues. The USFWS and the MDIFW do have regulatory authority to enforce federal and state laws that protect wildlife. Many wildlife-related laws (*e.g.*, the ESA) protect certain habitats that are critical to protected species. Both the MDIFW and municipalities in Maine enforce laws that prohibit many human behaviors that affect protected species. Additional protections continue to evolve through ordinances and legislative action. Unfortunately, some loss of habitat and human disturbance to protected species continues to occur, and more protections are often warranted. Regulatory agencies continue to advocate for additional protections when justified. Because WS does not have regulatory authority, and regulations to limit human

disturbance continue to develop, an alternative where WS and the USFWS manages human population growth and expansion was not considered in detail.

Protect Coyotes, which Would Allow a Balance in Mesopredator Populations

An alternative that provides for the protection of coyotes and other nest predators so those species can balance other wildlife populations was identified through the public scoping process. This alternative carries many assumptions for it to be successful at reducing predation effects. Aside from those assumptions, coyotes and other nest predators still threaten nesting waterbirds in multiple ways, including direct predation to nesting shorebirds (Koenen et al. 1996, Mabee 1997) and abandonment losses associated with the presence of predators near enclosed piping plover nests (Doherty and Heath 2011). Due to these reasons, this alternative was not considered in detail.

Use of Volunteers to Protect Nest Sites

Using volunteers to scare predators away from nesting areas was suggested as an alternative. Human presence is one method that is often used in the proposed alternative. An alternative that uses only human presence is not as likely to be as efficacious as one that uses multiple approaches. Further, securing the number of volunteers to achieve the objective would be unlikely. For example, in 2011, 27 pairs of piping plovers established 31 nests at 12 locations. Some nesting locations were large and the distance between nests would require multiple observers at each location. If volunteers covered an eight-hour shift, three people would be required to staff one nest for one day. Monitoring would need to be staffed seven days per week for nearly three months. With this level of staffing needed for piping plovers alone, hundreds of volunteers would be needed making this alternative impractical. Moreover, this alternative alone would likely be cost-prohibitive to manage even if sufficient volunteers could be attained. Finally, human presence alone does not ensure that predation would not occur, especially those attributed to some predators (*e.g*., gulls, raptors) during the chick stage. For these reasons, this alternative was not considered in detail.

Habitat Preservation Should be utilized as a Focal Point for Restoration

Habitat protection is considered a vital component in most recovery programs for T&E species, and piping plover, least tern, and roseate tern recovery goals are no exception. A great deal of emphasis has been placed in securing nesting and feeding habitats for these species and is identified in the respective plans (USFWS 1996, USFWS 1998, MDIFW 2005, MDIFW 2011*a*, MDIFW 2011*b*, MDIFW 2011*c*). In addition, Essential Habitat designation under the Maine Natural Resources Protection Act provides regulatory authority over the practices that are allowed where these species occur (previously discussed in Chapter 1). Furthermore, the RCNWR has purchased and preserved numerous properties throughout the history of the Refuge, and still considers land acquisition when feasible. While additional habitat protection for nesting waterbirds is desirable, it is not a likely outcome for all nesting areas for a variety of reasons including cost, current land ownership, or availability of willing sellers. An alternative that only uses habitat protection would not be sufficient protection to ensure reproductive success in perpetuity; therefore, this alternative was not considered in detail.

A Holding Facility Should be Established Instead of Lethal Control or Translocation

A suggestion provided from the public included an alternative where all nest predators would be live-captured and then, held in captivity for the remainder of the nesting season. After the nesting season, those nest predators would be released back into the areas where they were captured. WS and the USFWS do not believe this is a practicable alternative based on several reasons. First, the cost of holding animals would be prohibitive. Neither WS nor the USFWS have facilities or staff in place to adequately

care for and hold nest predators live-captured. Building the infrastructure and hiring employees to care for captive animals would require increased funding. It is possible that state-licensed animal rehabilitators could hold and care for captured wildlife; however, it is highly unlikely that any one facility would be capable of handling the volume of individuals and variety of species. Therefore, coordinating and transporting the animals to various holding facilities would be impractical and cost prohibitive to a program that struggles to acquire adequate funding to maintain recovery objectives.

In addition, there would be disease concerns associated with congregated wildlife in a holding facility. Many zoonotic diseases such as rabies, parvovirus enteritis, leptospirosis, canine distemper, tularemia, ascarid roundworm, sarcoptic mange, and others are known to infect the target species, and many of those diseases can be transmitted to humans and other animals. Diseases, such as those, can quickly spread throughout captive facilities. If diseases were not detected, those diseases could be introduced into the environment when animals were released. While this scenario is speculative, it carries a very serious threat to human and animal health.

Because this alternative would return nest predators to the areas where they were captured, animals would likely remain in those locations to present additional future threats. What further complicates this situation is that most animals would be much more difficult to recapture because they learn to avoid traps. This of course would mean that removing educated individuals would be increasingly difficult in subsequent years after animals were released from a holding facility. For this reason, this alternative would be counterproductive to the goals of the program. Due to these multiple conflicting situations, this alternative was not considered in detail.

3.3 STANDARD OPERATING PROCEDURES

SOPs improve the safety, selectivity, and efficacy of methods and activities. Those SOPs would be incorporated into activities conducted by WS when addressing nest predation 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 strategies and their potential impacts, would be consistently used and applied when addressing nest predation.

- WS' activities would be conducted pursuant to applicable federal, State, and local laws and regulation in accordance with WS Directive 2.210.

- WS would only conduct activities when requested and would only employ methods that have been agreed upon between WS and the cooperator requesting assistance.

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

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

- Pesticide use, storage, and disposal would conform to label instruction and other applicable laws and regulations, and Executive Order 12898.

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

- Immobilizing and euthanasia drugs would be used according to the Drug Enforcement Administration, FDA, WS' directives, and under the recommendation of a veterinarian.

- All controlled substances would be registered with the Drug Enforcement Administration or the FDA.

- WS' employees would follow approved procedures outlined in the WS' Field Manual for the Operational Use of Immobilizing and Euthanizing Drugs (Johnson et al. 2001).

- Non-target animals captured in live-capture traps would be released unless it was determined that the animal would not survive and/or that the animal could not be released safely.

- The take of nest predators would only occur when authorized by the MDIFW and/or the USFWS, when applicable, and only at levels authorized.

- WS has consulted with the MDIFW and the USFWS to ensure program activities comply with the ESA and the Maine Endangered Species Act.

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

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

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

- Management actions would be directed toward specific wildlife that are or likely would feed on eggs, nestlings, or adults of ground nesting waterbirds. Generalized population suppression across the State, or even across major portions of Maine, would not be conducted.

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

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 Activities on Target Wildlife Populations

- Lethal take of nest predators by WS would be reported to the MDIFW and to the USFWS annually to evaluate population trends and the magnitude of take of those species in the State.

- WS would only target those individuals or groups of individuals identified as nest predators in areas where nesting colonial waterbirds occur or could occur.

- The WS' Decision Model, designed to identify the most appropriate strategies and their potential impacts, would be used to determine strategies for reducing nest predation or risks of nest predation.

- WS would monitor activities the populations of those target wildlife species identified as nest predators to ensure activities do not adversely affect populations of those species in the State.

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

Issue 2 - Effects of Activities on the Populations of Non-target Wildlife

- 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.

- Personnel would use lures, trap placement, and capture devices that would be strategically placed at locations likely to capture a target animal and minimize the potential of non-target animal captures.

- As appropriate, capture devices would be equipped in such a manner to reduce the potential of capturing non-target animals (*e.g.*, pan tension devices).

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

- Live-traps would be checked frequently to ensure non-target species would be released in a timely manner to ensure survival.

- Trap monitoring devices would be employed, where applicable, to facilitate monitoring of the status of traps in remote locations to ensure any captured wildlife would be removed promptly to minimize pain and distress.

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

- Carcasses of nest predators retrieved after activities had been conducted would be disposed of in accordance with WS Directive 2.515.

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

- WS would follow those procedures as outlined in the predation management plan developed between WS and the MDIFW (see Appendix I).

Issue 3 – Effects of Activities on Threatened and Endangered Species

- WS has consulted with the USFWS and the MDIFW to evaluate activities to resolve nest predation and threats to ensure the protection of T&E species. As a result, WS diligently implements the USFWS recommendations to avoid adverse effects on T&E species; those

recommendations are included in the following SOPs.

- WS would follow those procedures as outlined in the predation management plan developed between WS and the MDIFW (see Appendix I).

- Shooting activities would only involve the occasional discharge of firearms in proximity of T&E species. As appropriate, suppressed firearms would be used to minimize noise associated with the discharge of the firearm. Multiple shots in rapid succession would be avoided.

- When conducting nighttime activities, night vision equipment, infrared devices, or red filtered spotlights could be utilized.

- Human presence at control sites would be kept to the minimum time needed to accomplish the management action. When possible, WS would use trap monitors to check traps remotely to minimize the human disturbance in areas where colonial waterbirds nest.

- WS' activities would most frequently occur outside of the symbolically fenced piping plover nesting areas.

- WS would maintain close coordination with T&E species biologists to document nest locations and to avoid/minimize disturbance.

- All foothold traps, cage traps, restraining cables, and body gripping traps would be placed outside of the immediate nesting areas. Location and baiting of traps would balance the efficacy of predator removal against risks of attracting predators to nesting areas.

- In using non-lethal techniques to deter predators, WS would not use methods in areas that may cause disturbance to T&E species.

- Conditions specific to avoiding state endangered New England cottontail rabbits would be followed as specified in the Predator Management Plan to Improve Piping Plover and Least Tern Nesting Success in Maine (see Appendix I).

Issue 4 - Effectiveness of Methods and Strategies for Alleviating Nest Predation Risks

- The appropriateness and effectiveness of methods 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 would be used to resolve nest predation.

Issue 5 - Effects of Management Methods on Human Health and Safety

- Activities would be conducted professionally and in the safest manner possible. Most 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), when appropriate.

- Alleviating predation risk via shooting would be conducted professionally and in the safest manner possible. Shooting would be conducted during times when public activity and access to

the control areas would be restricted. Personnel involved in shooting operations would be fully trained in the proper and safe application of this method.

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

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

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

- Carcasses of nest predators retrieved after activities were conducted would be disposed of in accordance with WS Directive 2.515.

Issue 6 - Effects on the Socio-cultural Elements of the Human Environment

- Management actions to reduce or prevent nest predation would be directed toward specific individuals of nest predators identified as responsible for predation or identified as posing a threat of nest predation.

- All methods or techniques applied to resolve nest predation 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.

- WS would collaborate with the USFWS, the MDIFW, and Maine Audubon to provide public outreach.

Issue 7 - Humaneness and Animal Welfare Concerns of Methods

- Personnel would be well trained in the latest and most humane devices/methods for targeting nest predators.

- WS' personnel would check methods frequently or apply trap monitors to ensure any captured wildlife would be addressed promptly to minimize the amount of time an animal was restrained.

- WS' use of euthanasia methods would follow those recommended by WS' directives (WS Directive 2.505).

- The NWRC would be continually conducting 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 nest predation.

Issue 8 - Effects of Nest Predator Management Activities on the Regulated Harvest of Those Species

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

- Management actions to reduce or prevent nest predation in the State would be directed toward specific individuals identified as responsible for predation or identified as posing a threat of nest predation.

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

- WS' activities to manage predation risks caused by nest predators would be coordinated with and conducted under permits issued by the USFWS and/or the MDIFW, when required.

- WS' lethal take (killing) of mammalian nest predators would be reported to and monitored by the MDIFW to ensure WS' take was considered as part of management objectives for those species in the State. The lethal take of birds would be reported annually to the USFWS to ensure take would occur within population objectives.

- WS would monitor activities to ensure activities do not adversely affect the populations of those nest predators in the State.

Issue 9 - Effects on Recreation in Areas Where Nest Predation Management Activities Occur

- Management activities conducted to target nest predators would occur only in areas where nesting was occurring or has historically occurred.

- Most 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 was low (*e.g.*, early morning), when appropriate.

- The majority of activities would occur before the nesting areas reach peak use by people recreating on beaches.

- Because access to waterbird nesting areas would be restricted or prohibited by the property manager to prevent disturbance of nesting waterbirds, nest predator activities would not likely further restrict recreational use of those areas.

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 from 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 MDIFW, the USFWS, and the MDABPC.

Issue 1 - Effects of Activities on Target Wildlife Populations

A common issue is whether activities conducted to alleviate or prevent nest predation would adversely affect the populations of target wildlife species. As was discussed previously, methods available to address nest predation or threats of predation in the State that would be available for use or recommendation by WS under Alternative 2 (technical assistance only), Alternative 3 (technical and operational assistance), and Alternative 4 (non-lethal methods only) would either be lethal methods or non-lethal methods. Many of those methods would also be available for use by other entities under those alternatives. Similarly, many of those methods would also be available for use by other entities under Alternative 1 (no WS involvement). Under Alternative 2, WS could recommend lethal and non-lethal methods as part of an integrated approach to resolving requests for assistance. Alternative 3 addresses requests for assistance received by WS through technical and operational assistance where an integrated approach to methods would be employed and/or recommended. Under Alternative 4, WS would recommend and employ only non-lethal methods in an integrated approach to managing nest predation.

Non-lethal methods that would be available under the alternatives would include, but would not be limited to habitat/behavior modification, pyrotechnics, visual deterrents, live traps, translocation, cable restraints, exclusionary devices, frightening devices, nets, chemical frightening agents, immobilizing drugs, and chemical repellents (see Appendix B for a complete list and description of potential methods). No assistance would be provided by WS under Alternative 1 but many of those methods available to address nest predation would continue to be available for use by other entities under Alternative 1.

Many of the non-lethal methods can disperse or otherwise make an area unattractive to nest predators; thereby, reducing the presence of those species at the site and potentially the immediate area around the site where non-lethal methods were employed. Non-lethal methods would be given priority when addressing requests for assistance under Alternative 2 and Alternative 3 (see WS Directive 2.101), and only non-lethal methods would be employed or recommended under Alternative 4. Non-lethal methods would not necessarily be employed or recommended to resolve every request for assistance if deemed inappropriate by WS' personnel using the WS Decision Model, except under Alternative 4. 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 reducing predation or the threat of predation.

Many non-lethal methods would be used to excluded, harass, and disperse target wildlife from areas where predation or threats were occurring. When effective, non-lethal methods would disperse nest predators from the area resulting in a reduction in the presence of those species at the site where those methods were employed. However, those species would be dispersed to other areas with minimal impact on those species' populations. 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. Non-lethal methods are generally regarded as having minimal impacts on overall populations of wildlife since individuals of those species would be unharmed. The use of non-lethal methods would not have adverse effects on populations of nest predators in the State under any of the alternatives.

The continued use of non-lethal methods often leads wildlife to habituate to those methods, which can decrease the effectiveness of those methods. For any management methods employed, the proper timing would be essential in effectively dispersing predators to reduce predation risks. Employing methods soon after predation begins or soon after threats have been identified, increases the likelihood that those management activities would achieve success in addressing or preventing nest predation. Therefore, coordination and timing of methods would be necessary to be effective in achieving expedient resolution of nest predation.

In addition to non-lethal methods, lethal methods would also be available for use under all the alternatives by WS and/or by other entities. Lethal methods considered by WS to address nest predation would include live-capture followed by euthanasia, shooting, body-gripping traps, fumigants, DRC-1339, euthanasia chemicals, and the recommendation of hunting and/or trapping, where appropriate. Euthanasia using carbon dioxide or by using a euthanasia chemical would occur once target wildlife were live-captured using other methods. In addition, gunshot could be employed to euthanize live-captured wildlife. All of those lethal methods would be available for use by WS or for recommendation by WS under Alternative 2 and Alternative 3, except for DRC-1339 and euthanasia chemicals[7]. Lethal methods could be employed by WS under Alternative 3 only after receiving a request for the use of those methods. Those same methods would also be available for WS to recommend and for other entities to use under Alternative 2. Under Alternative 1 and Alternative 4, those same lethal methods would continue to be available for use by other entities despite the lack of involvement by WS (Alternative 1) or the recommendation of non-lethal methods only (Alternative 4).

When live-captured target animals were to be lethally taken by WS under Alternative 3, take would occur pursuant to WS Directive 2.505 and WS Directive 2.430. Under alternative 2, WS would recommend the use of methods to lethally take live-captured or restrained target animals in accordance with WS Directive 2.505. No assistance would be provided by WS under Alternative 1; however, many of those methods available to lethally take live-captured or restrained animals would continue to be available for use by other entities. Those same methods would be available under Alternative 4; however, WS would only recommend non-lethal methods to those persons requesting assistance.

The use of lethal methods by any entity could result in local population reductions in the area where predation or threats were occurring since individual nest predators would be removed from the population. Lethal methods could be employed or recommended to remove target wildlife that have been identified as nest predators or those target wildlife that pose a risk of nest predation. Therefore, the use of lethal methods could result in local reductions of nest predators in the area where predation or threats

[7]Although euthanasia chemicals would not be available to most entities, licensed veterinarians and those persons under their supervision (*e.g.*, wildlife professionals) could use euthanasia chemicals. In addition, other methods could be employed to kill captured wildlife despite euthanasia chemicals being unavailable for use by other entities.

were occurring. The number of individuals removed from a species' population by WS using lethal methods under Alternative 3 would be dependent on the number of requests for assistance received, the number of nest predators involved with the associated predation or threat, and the efficacy of methods employed. The number of nest predators removed by other entities under Alternative 1, Alternative 2, and Alternative 4 would be unknown but would likely be similar to the take that could occur under Alternative 3 since the same methods (except DRC-1339 and in some cases, euthanasia chemicals) would be available.

Most lethal methods are intended to reduce the number of nest predators present at a location because a reduction in the number of nest predators at a location can lead to a reduction in predation, which is applicable whether using lethal or non-lethal methods. The intent of non-lethal methods is to harass, exclude, or otherwise make an area unattractive to nest predators, which disperses those animals to other areas leading to a reduction in predation risks at the location where those individuals were dispersed. The intent of using lethal methods would be similar to the objective trying to be achieved when using non-lethal methods, which is to reduce the number of individuals in the area where predation was occurring or could occur, which can lead to a reduction in the risks of predation occurring at that location.

The avicide DRC-1339 could also be used under the proposed action (Alternative 3) and applied as part of an integrated approach. DRC-1339 would be available to manage predation risks associated with crows and gulls. Similar to other lethal methods, very little information is available on the effectiveness of DRC-1339 to reduce predation. However, like other methods, including non-lethal methods, the intent in using DRC-1339 would be to reduce the number of crows or gulls present at a location where predation or threats of predation were occurring. Reducing the number of crows and gulls at a location where predation or threats were occurring either using non-lethal methods or lethal methods could lead to a reduction in predation. The dispersal of birds using non-lethal methods reduces 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 also occur if lethal methods were employed. Similarly, the use of DRC-1339 would be intended to reduce the number of crows and gulls 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.

Although the use of firearms can reduce the number of nest predators using a location (similar to dispersing predators), the use of a firearm is most often used to supplement and reinforce the noise associated with non-lethal methods. The capture of nest predators using live-traps and subsequently euthanizing those animals would be employed to reduce the number using a particular area where predation was occurring or could occur.

Similarly, the recommendation that nest predators be harvested during the regulated hunting and/or trapping season for those species in the State would be intended to manage those populations in an area where predation was occurring or could occur. Establishing hunting and trapping seasons and the allowed take during those seasons is the responsibility of the MDIFW and/or the USFWS. WS does not have the authority to establish hunting or trapping seasons or to set allowed harvest numbers during those seasons. However, the harvest of those nest predators with hunting and/or trapping seasons in the State would be occurring in addition to any take that could occur by WS or authorized under the alternatives. In addition, those species identified as nest predators could also be lethally removed by other entities to alleviate damage or threats of damage occurring to other resources (*e.g.*, property, agriculture). The total number of individuals from each species that are lethally removed by other entities to alleviate damage or threats of damage is currently not available for the mammal species and for crows. Table 4-1 shows the statewide, annual estimated harvest levels of several of the mammal species addressed in this EA by year between the 2003/04 harvest season and the 2010/11 season. However, the total number of individuals from each species that are lethally removed by other entities to alleviate damage or threats of damage is

currently not available. Harvest information for those species not addressed in Table 4-1 is not currently available.

Table 4-1. The registered harvest of furbearing animals within the State of Maine from the 2003/2004 to 2010/2011 hunting and trapping seasons (MDIFW 2011*d*)

SPECIES	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11
Red Fox	1,535	1,413	1,067	1,245	1,030	893	932	922
Gray Fox	196	125	67	107	161	163	250	332
Coyote	2,459	2,175	2,077	1,521	1,819	1,901	1,743	1,623
Mink	904	1,224	1,108	2,280	1,888	1,297	1,465	1,926

While recreational trapping is legal in some areas where activities could occur, the degree of this activity is unknown. It is likely that recreational trapping activities do not occur in many areas where nesting occurs or where nesting could occur, especially on off shore islands. Even when harvest does occur, it is unlikely that the level of take would be sufficient to alter local populations or reduce predation threats. Furthermore, some locations where nesting waterbirds occur may be closed to the recreational trapping of furbearers (*e.g.*, at the RCNWR). Recreational trappers may actually avoid coastal communities do to social conflicts and the risks of catching pets. In addition, across the United States, in general, participation in trapping has been declining since the 1980s (Seimer et al. 1994, Daigle et al. 1998), and Maine trends are similar with trapping license sales decreasing from 5,182 resident licenses in 1980 to 1,974 licenses sold in 2011 (MDIFW 2011*d*).

Often of concern with the use of lethal methods is that nest predators removed would be replaced by other nest predators either directly after removing the target animal (*e.g.*, from other animals that immigrate into the area) or the following year after reproduction occurs (*e.g.*, increase in reproduction that could result from less competition). As stated previously, the use of lethal methods by WS would not be intended to manage nest predator populations over a broad area, only to reduce the number of individuals at the local area where T&E species nest. The use of lethal methods would be intended to reduce the number of target species present at a location where predation was occurring by targeting those animals that feed on eggs, nestlings, and/or adults or that poses a threat of predation. Therefore, the effectiveness of methods would be based on the ability to reduce predation risks caused by those individual animals responsible for those risks.

For example, 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 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 increasing number of crows using 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 nest predators to areas where methods were previously employed does not indicate previous use of those methods were ineffective since the intent of those methods were to reduce the number of nest predators present at a site where predation was occurring or could occur at the time those methods were employed.

Most lethal and non-lethal methods currently available provide only short-term benefits when addressing nest predation. Those methods would be employed to reduce predation or the threat of predation occurring at the time those methods were employed but do not necessarily ensure nest predators would not return once those methods were discontinued or after the reproductive season (when young disperse and occupy vacant areas). Long-term solutions to resolving nest predation can often be difficult to implement and can be costly. In some cases, long-term solutions involve exclusionary devices, such as fencing. When addressing nest predation, long-term solutions generally involve modifying existing habitat or making conditions to be less attractive to predators. To ensure complete success, alternative sites in areas where damage was not likely to occur would often times be required to achieve complete success in reducing nest predation and to avoid moving the problem from one area to another. Modifying a site to be less attractive to nest predators would likely result in the dispersal of those wildlife to other areas where damage could occur or could result in multiple occurrences of damage situations.

WS would maintain ongoing contact with the USFWS and the MDIFW. In addition, WS would submit annual migratory bird activity reports to the USFWS and annual take reports to the MDIFW under Alternative 3. 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. Similarly, the MDIFW would monitor the take and populations of those target species in the State. To ensure against population-level effects, the MDIFW and the USFWS would monitor the estimated take of nest predators from all sources and use survival estimates that compensate for other natural causes of mortality (*e.g.*, predation, disease).

In addition, WS would monitor activities to ensure activities remained within the scope of the analyses conducted in this EA. 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 populations and trends are often derived from several sources including the published literature and harvest data. Ongoing contact with USFWS and the MDIFW assures local, State, and regional knowledge of wildlife population trends would be considered. The issue of the potential impacts of conducting the alternatives on the populations of those target wildlife species addressed in this assessment is analyzed for each alternative below.

Alternative 1 – No Involvement by WS in Managing Predation Risks

Under this alternative, WS would not conduct activities to alleviate nest predation risks in the State. WS would have no direct involvement with any aspect of addressing nest predation and would provide no technical assistance. No take of nest predators by WS would occur in the State. Those nest predators identified could continue to be lethally taken to resolve predation and/or threats occurring through the issuance of permits by the MDIFW and/or the USFWS, when required. Crows could be lethally taken in accordance with the blackbird depredation order established by the USFWS.

Local populations of nest predators could decline, stay the same, or increase depending on actions taken by those entities involved with managing nest predation. Some resource/property owners may hunt or allow other hunters access to hunt those nest predators during the hunting season. Those mammalian predators can also be harvested in the State during annual trapping seasons. Crows could still be lethally taken under the depredation order to alleviate nest predation in the State. Some local populations of nest predators would temporarily decline or stabilize where hunting pressure and permitted removal activities were adequate. While WS would provide no assistance under this alternative, other individuals or entities could conduct activities using lethal methods resulting in the removal of nest predators at levels similar to the proposed action.

Because the take of nest predators by other entities could occur despite no involvement by WS, and those

nest predators would continue to be harvested during the regulated harvest season at the discretion of the USFWS and/or the MDIFW, the potential effects on the populations of those nest predators in the State would be similar among all the alternatives for this issue. All of the proposed alternatives require the MDIFW or the USFWS to permit activities. Under alternative 1, other entities could still manage nest predation that would require permits by the USFWS and/or the MDIFW. If the MDIFW and the USFWS chose to permit the management of nest predation by other entities under alternative 1, the take of the target species could be comparable to the number lethally removed under the other alternatives.

Alternative 2 – Managing Nest Predation Risks by WS through Technical Assistance Only

Populations of target wildlife species in the State would not be directly affected by WS from a program implementing technical assistance only. However, other entities could implement methods based on WS' recommendations. Under a technical assistance only alternative, WS would recommend and demonstrate for use both non-lethal and lethal methods legally available for use to resolve nest predation. Methods and techniques recommended would be based on WS' Decision Model using information provided from the requestor or gathered during a site visit. Requestors may implement WS' recommendations, implement other actions, or take no action. However, those persons requesting assistance would likely be those people that would implement methods in the absence of WS' recommendations. As with the other alternatives, a permit from the MDIFW would be required to take mammalian nest predators outside of the regulated hunting and trapping season where a hunting and/or trapping license would be required. The take of American crows can occur under the depredation order for blackbirds and therefore, a depredation permit from the USFWS would not be required to take crows outside of the hunting season when a hunting license would be required. The take of crows outside of the hunting season could occur with approval from the MDIFW. The take of the other migratory birds could also be achieved by other entities if a depredation permit was issued by the USFWS.

Under this alternative, the number of nest predators lethally taken would likely be similar to the other alternatives since take could occur through the issuance of permits when required, under the blackbird depredation order for crows, a USFWS depredation permit, or during the hunting and trapping seasons. WS' participation in a management action would not be additive to an action that could occur in the absence of WS' participation.

With the oversight of the MDIFW and the USFWS, it is unlikely that nest predator populations would be adversely affected by implementation of this alternative. Under this alternative, WS would not be directly involved with actions associated with reducing nest predation risks and therefore, direct operational assistance could be provided by other entities, such as the MDIFW, the USFWS, municipal authorities, and/or private entities. Therefore, the take of those nest predators identified would likely to be similar across the alternatives.

Alternative 3 - Continuing the Current Integrated Approach to Managing Nest Predation (Proposed Action/No Action)

Under the proposed action/no action alternative, WS would continue to provide both technical assistance and direct operational assistance to those persons requesting assistance with managing nest predation in the State. WS would employ those methods described in Appendix B in an adaptive approach that would integrate methods to reduce predation and threats associated with nest predators. The issue of the effects on the populations of those individual species arises from the use of methods to address the need for reducing nest predation. Methods employed in an integrated approach to reduce predation are categorized into non-lethal and lethal methods. As part of an integrated approach to managing predation risks, WS could apply both lethal and non-lethal methods when requested by those persons who own or manage property where nest predation has occurred or could occur.

As discussed previously, non-lethal methods are generally regarded as having minimal impacts on overall populations of wildlife since those species would be unharmed. The use of non-lethal methods would have no adverse effects on target wildlife populations in the State. Lethal methods could be employed to resolve predation associated with those target wildlife identified by WS as responsible for feeding on eggs, nestlings, fledglings, and/or adults of ground nesting waterbirds. Activities using lethal methods would only be conducted after receiving a request for such assistance and only after a permit had been issued for the take of wildlife species by the MDIFW and/or the USFWS, when required. The use of lethal methods would therefore result in local reductions of nest predators in the area where predation or threats were occurring. The number of individuals of each wildlife species removed from the population using lethal methods under the proposed action would be dependent on the number of requests for assistance received, the number of individuals of a given wildlife species involved with the associated predation risks, and the efficacy of methods employed.

Although the absolute number of nest predators that could be lethally taken by WS under Alternative 3 may vary depending on the number of requests received, the number of individual nest predators involved nest predation, and the efficacy of methods employed. WS has established the maximum number of individuals of each nest predator that could be taken under Alternative 3, and those numbers are analyzed by species below but are referenced in Table 4-2. The analysis of potential impacts on each of the species populations includes an estimate of annual take by WS as compared to statewide population estimates of the species, when available. The statewide population for each species has been estimated using the most current, reliable information possible, when available.

Table 4-2. Anticipated take by WS for each target species, the estimated population size by species, and the percent of take in relation to the population size for the proposed alternative.

Species	Maximum Take[†]	Estimated State Population Size[‡]	% of Total Population
Virginia Opossum	50	3,540	**1.4%**
Raccoon	150	121,500	**0.12%**
Striped Skunk	50	128,077	**0.04%**
Coyote	20	10,000	**0.2%**
Red Fox	30	81,479	**0.04%**
Gray Fox	20	4,573	**0.44%**
Mink	20	77,000	**0.03%**
Long-tailed Weasel	10	69,400	**0.01%**
Short-tailed Weasel	10	81,000	**0.01%**
Feral/domestic cats	20*	N/A**	**N/A**
Feral/domestic dogs	5*	N/A	**N/A**
Eastern Chipmunk	75	10,990,729	**0.0007%**
American Crows	200	270,000	**0.07%**
American kestrels	5*	9,000	**N/A**
Merlins	5*	700	**N/A**
Great-horned Owls	5*	1,500	**N/A**
Ring-billed Gulls	50	54,000	**0.09%**
Herring Gulls	50	24,855	**0.2%**
Great black-backed Gulls	100	9,536	**1.05%**
Laughing Gulls	700	3,565	**19.64%*** **

[†] Maximum take under the proposed action to alleviate or reduce risks of nest predation; take figures do not include take that could occur during other damage management activities conducted by WS; cumulative take is addressed in the accounts for each species

[‡] Estimates for each species population are further discussed in Chapter 4

* Numbers marked with an asterisk indicate that no lethal take would occur under the proposed action to alleviate nest predation risks
**N/A=information is currently unavailable
***This take is based on the USFWS' Laughing Gull Management Plan for Seabird Restoration Islands (USFWS 2008) in Maine, which aims to reduce the existing population of laughing gulls in Maine.

The number and species of nest predators addressed by WS using lethal methods from the federal fiscal year (FY) 2007 through FY 2011 are shown in Table 4-3. Often of concern with the use of lethal methods is that nest predators that were lethally taken would only be replaced by other nest predators either from other predators that migrate into the area or by predators the following year from increases in reproduction that could result from less competition. As stated previously, the use of lethal methods would not be used as population management tools (except for hunting and trapping) over broad areas. The use of lethal methods would be intended to reduce the number of nest predators present at a location where predation or the risk of predation was occurring by targeting those individuals predating on eggs, nestlings, and/or adults of ground nesting waterbirds or posing threats of predation. Since the intent of lethal methods would be to manage individual nest predators and not to manage entire populations, those methods would not be deemed ineffective if nest predators return.

Table 4-3. The number of animals killed statewide (total) and the portion taken to protect nesting T&E birds (nest) by the WS program in Maine from FY 2007 to FY 2011.

Species	2007		2008		2009		2010		2011	
	Total	Nest	Total	Nest	Total	Nest	Total	Nest	Total	Nest
Red Fox	**1**	1	**9**	8	**9**	6	**12**	10	**18**	18
Gray Fox	**0**	0	**2**	0	**2**	1	**12**	9	**10**	10
Coyote	**2**	1	**8**	0	**3**	0	**3**	0	**6**	4
Raccoon	**40**	27	**62**	53	**44**	43	**91**	91	**65**	62
Opossum	**3**	3	**3**	3	**5**	5	**15**	15	**8**	8
Striped Skunk	**3**	0	**22**	19	**12**	7	**20**	18	**15**	6
Long-tailed Weasel	**0**	0	**0**	0	**2**	2	**3**	3	**0**	0
Short-tailed Weasel	**0**	0	**0**	0	**0**	0	**0**	0	**1**	1
Feral/domestic cats	**0**	0	**0**	0	**1**	0	**6**	0	**0**	0
Eastern Chipmunk	**0**	0	**0**	0	**0**	0	**34**	34	**41**	41
American Crows	**17**	17	**12**	12	**7**	7	**29**	29	**5**	5
Herring Gulls	**104**	31	**47**	0	**81**	0	**131**	15	**161**	6
Ring-billed Gulls	**196**	41	**257**	0	**234**	0	**236**	1	**254**	1
Great Black-backed Gulls	**9**	2	**17**	12	**16**	10	**37**	28	**8**	4

WS' take that could occur to alleviate predation or threats of predation under the proposed action would be monitored by comparing numbers of animals killed with overall populations or trends in populations to assure the magnitude of take was maintained below the level that would cause adverse effects to the viability of native species' populations. In addition, WS' estimated take would be compared cumulatively with other known mortality, such as the number harvested during the hunting or trapping season. The potential impacts on the populations of target species from the implementation of the proposed action are analyzed for each species below.

Virginia Opossum Population Information and Effects Analysis

Opossums are the only marsupials (possess a pouch in which young are reared) found north of Mexico (Seidensticker et al. 1987). They frequent most of the eastern and central United States, except Minnesota, northern Michigan, and New England, extending west to Wyoming, Colorado, and central New Mexico (National Audubon Society 2000). They are also found in parts of the southwestern United

States, California, Oregon, and Washington (Jackson 1994). It has been documented that human activities have aided in the range expansion of opossum (Gardner 1982). Adult opossums range in size from less than 1 kg (2.2 lbs) to about 6 kg (13 lbs), depending on sex and time of year. They grow throughout life (Seidensticker et al. 1987). They have a broad range of pelage colors, but opossum are usually considered as "*gray*" or "*black*" phase. Their fur is grizzled white above; long white hairs cover black tipped fur below. They climb well and feed on a variety of foods, including carrion, which forms much of its diet. In addition, opossum eat insects, frogs, birds, snakes, small mammals, earthworms, berries, and other fruits; persimmons, apples, and corn are favorite foods (National Audubon Society 2000). They use a home range of four to 20 hectares (10 to 50 acres), foraging throughout this area frequently (Jackson 1994), but concentrating on a few sites where fruits abound, when they are in season (Seidensticker et al. 1987).

The reproductive season of the Virginia opossum typically occurs from December to February, depending on latitude (Gardner 1982). Gestation is short (average of 12.8 days) with one to 17 young born in an embryonic state, which climb up the mothers belly to the marsupium (pouch), attach to teats, and begin to suckle (Gardner 1982, National Audubon Society 2000). Those young remain in the pouch for about two months. After two months, young begin to explore outside of the pouch and may be found traveling on their mother's back with their tails grasping hers (Whitaker, Jr., and Hamilton, Jr. 1998). Opossums live for only one to two years, with as few as 8% of a population of those animals surviving into the second year in a study in Virginia conducted by Seidensticker et al. (1987). In that five-year study, Seidensticker et al. (1987) also observed that there was a wide variation in opossum numbers, in what was considered excellent habitat for the species. Those variations were observed seasonally and in different years. However, the mean density during the study was 10.1 opossum per square mile with a range of 1.3 opossum per square mile to 20.2 opossum per square mile (Seidensticker et al. 1987). This was comparable to other opossum population densities in similar habitats in Virginia. Verts (1963) found a density estimate of 10.1 opossum per square mile in farmland areas in Illinois, while Wiseman and Hendrickson (1950) found a density of 6.0 opossum per square mile in mixed pasture and woodlands in Iowa. However, VanDruff (1971) found opossum densities in waterfowl nesting habitat as high as 259 opossum per square mile.

Opossums are classified as a furbearer in Maine and can be harvested during a regulated trapping season that allows no take limit (MDIFW 2010). There are no tagging requirements for opossums in Maine, and therefore, no harvest information is available. When opossums are involved in property or agricultural damage, a landowner or their agent may kill or have killed those opossums (12 MRSA §12401, 12 MRSA §12402). Opossums are absent in the northern two-thirds of Maine, but are relatively common throughout southern Maine, where nesting of plovers and terns occurs. There is some indication that opossums are slowly expanding their range northward.

There is currently no population estimate or harvest data for opossum in Maine. To determine an estimated population in Maine, the best available data will be used. Knowing that opossums are not located statewide, but that they do exist commonly in southern Maine, and that much of the activities proposed under this alternative would occur largely in York, Cumberland, and Sagadahoc counties, this analysis will evaluate potential impacts from the removal of opossum to reduce predation risks in those three counties. There are approximately 1,894 mi^2 of forestland (Griffith and Alerich 1996) and 73 mi^2 of cropland (USDA 2009) in York, Cumberland, and Sagadahoc counties. Using the assumptions that only 75% of the forest and croplands throughout these counties have sufficient habitat to support opossum, opossum are only found in these habitats, and opossum densities average 2.4 opossum per square mile, a three-county opossum population could be conservatively estimated at approximately 3,540 opossum. Considering opossum inhabit a large variety of habitats, including urban areas, and occupy more than 75% of the forested and cropland habitat available, an estimate of 3,540 opossum is likely low.

To alleviate nest predation, 34 opossum have been lethally taken by WS to protect T&E species in Maine from FY 2007 through FY 2011, which is an average of 6.8 opossum per year. During this same time, no additional opossum were taken by WS on other projects. Based on previous requests for assistance received by WS to manage nest predation and in anticipation of additional requests for assistance, WS could lethally remove up to 50 opossum annually in the State as part of efforts to reduce nest predation. To ensure a cumulative analysis of the potential take of opossum for reducing risks of nest predation and other damage management activities conducted by WS throughout Maine, this EA will evaluate the lethal take of up to 100 opossum annually; however, take of opossum to alleviate nest predation would not exceed 50 opossum. Given the population estimates in the State, the take of 100 opossum by WS annually would represent 2.8% of the estimated population in York, Cumberland, and Sagadahoc Counties, if the overall population remained at least stable. Although the number of opossum lethally taken in the State during the annual hunting and trapping seasons and for damage management is unknown, the cumulative take of opossum, including the proposed take of up to 100 opossum annually by WS, would not reach a magnitude where adverse effects would occur to the statewide opossum population. The permitting of the take by the MDIFW, which has management authority of wildlife species in the State, ensures the cumulative take of opossum would occur within allowable take levels to achieve the desired population levels. The unlimited take allowed by the MDIFW during the regulated harvest seasons also provides an indication that opossum are not likely to be overharvested.

Raccoon Population Information and Effects Analysis

The raccoon is a stocky mammal about 61 to 91 cm (2 to 3 feet) long, weighing 4.5 to 13.5 kg (10 to 30 lbs). It is distinctly marked, with a prominent black mask over the eyes and a heavily furred, ringed tail. The animal is a grizzled salt-and-pepper gray and black above, although some individuals are strongly washed with yellow (Boggess 1994*a*).

The raccoon is omnivorous, with one of the most varied diets of any animal. Raccoons will eat carrion, garbage, birds, mammals, insects, crayfish, mussels, other invertebrates, and a wide variety of grains, various fruits, other plant materials, and most or all foods prepared for human or animal consumption (Sanderson 1987). They occasionally kill poultry (Boggess 1994*a*).

The raccoon is found throughout most of the United States, with the exception of the higher elevations of mountainous regions and some areas of the arid southwest (Boggess 1994*a*, National Audubon Society 2000). Raccoons are more common in the wooded eastern portions of the United States than in the more arid western plains (Boggess 1994*a*), and are frequently found in cities or suburbs as well as rural areas (National Audubon Society 2000). Movements and home ranges of raccoons vary according to sex, age, habitat, food sources, season, and other factors. In general, males have larger home ranges than females. Home range diameters of raccoons have been reported as being one to three kilometers (0.6 to 2.9 miles) maximum, with some home range diameters of dense suburban populations to be 0.3 to 0.7 kilometers (0.2 to 0.4 miles).

Absolute raccoon population densities are difficult or impossible to determine because of the difficulty in knowing the percentage of the population counted and the additional difficulty of knowing how large an area the raccoons are using (Sanderson 1987). Due to their adaptability, raccoon densities reach higher levels in urban areas than that of rural areas. Relative raccoon population densities have been variously inferred by take of animals per unit area. For instance, Twichell and Dill (1949) reported removing 100 raccoons from tree dens in a 41-hectare (101 acres) waterfowl refuge area, while Yeager and Rennels (1943) studied raccoons on 881 hectares (2,177 acres) in Illinois and reported trapping 35 to 40 raccoons in 1938-1939, 170 in 1939-1940, and 60 in 1940-1941. Slate (1980) estimated one raccoon per 7.8 hectares (19.3 acres) in predominantly agricultural land on the inner coastal plain of New Jersey. Kennedy et al. (1991) estimated 13 raccoons per 100 ha (1 raccoon per 19 acres) of lowland forest in

Tennessee. Raccoon densities of 100 raccoons per square mile (1 raccoon per 6.4 acres) have been attained around abundant food sources (Kern 2002). Riley et al. (1998) summarized rural raccoon densities based on published literature that ranged from nearly two raccoons to almost 650 raccoons per square mile in rural habitats, which was an average of 10 to 80 raccoons per square mile.

In Maine, raccoons cause damage to gardens, residential and non-residential buildings, domestic fowl, and pets, as well as general property damage. Results of their feeding may be the total loss of ripened sweet corn in a garden. Damage to buildings generally occurs when they seek to gain entry or begin denning in those structures. Raccoons may den in uncapped chimneys, or may tear off shingles or fascia boards to gain access to attics or wall spaces. They may also damage or destroy sod by rolling it up in search of earthworms and other invertebrates (Boggess 1994*a*).

The public are also concerned about health and safety issues associated with raccoons. Those diseases include, but are not limited to, canine distemper and rabies, and the roundworm *Baylisascaris procyonis*, the eggs of which survive for extremely long periods in raccoon feces and soil contaminated by them. Ingestion of those eggs can result in serious or fatal infections in other animals as well as humans (Davidson and Nettles 1997).

WS provides assistance with addressing the spread of raccoon rabies in Maine. Those activities are part of the national rabies barrier program covered under separate environmental analyses (USDA 2005). Raccoons killed under the rabies program are addressed in a separate EA (USDA 2005), but are included in this EA for cumulative impact analysis.

Raccoons are classified as furbearers in Maine with a regulated hunting and trapping season with unlimited take allowed by the MDIFW. During the annual hunting season for raccoons, hunters can take an unlimited number of raccoons both daily and seasonally. During the development of this EA, there were no limits on the number of raccoons that could be trapped daily or in possession during the annual trapping season in the State. Raccoons are classified as "*home and garden*" damage species, and when involved in property or agricultural damage, a landowner or their agent may kill or have killed those raccoons (12 MRSA §12401, 12 MRSA §12402) without permission from a game warden or regional wildlife biologist. The number of raccoons taken annually in the State to alleviate damage or threats of damage is unknown.

In 1985, the raccoon population in Maine was estimated at 120,700 individuals and was projected to increase to 121,500 by 1990. The MDIFW also noted that the only factor that would limit a stable to increasing raccoon population in Maine was disease (Connoly 1986).

Between FY 2007 and FY 2011, WS has lethally removed 276 raccoons in Maine to alleviate or prevent predation of ground nesting plovers and terns, representing an average take by WS of 55.2 raccoons annually. The statewide take of raccoons by WS from FY 2007 to FY 2011 during all damage management activities was 302 raccoons (see Table 4-3). WS estimates that up to 150 raccoons could be lethally removed to alleviate nest predation. Based on previous requests for assistance and in anticipation of receiving additional requests, WS could lethally remove up to 300 raccoons annually in the State to alleviate all requests for assistance, including requests to alleviate or prevent nest predation. Using the population estimate in 1990 of 121,500 individuals, lethal take of up to 300 raccoons would represent 0.3% of the estimated statewide population in Maine, if the population has remained at least stable.

Activities conducted to prevent the further spread of raccoon rabies in the State generally do not result in the lethal take of raccoons. Raccoons are live-captured, sampled, and released on-site as part of the post-baiting protocols. However, if raccoons were visibly injured or exhibited signs of disease, those raccoons would often be euthanized. The number of raccoons lethally taken in the State during the post-baiting

trapping varies, but is not likely to exceed 50 individuals (USDA 2005). These 50 animals would be included in the statewide take of 300 raccoons. As stated previously, the number of raccoons harvested annually in the State during the hunting and trapping season for raccoons is unknown. In addition, the total number of raccoons lethally removed in the State to alleviate damage associated with raccoons is unknown.

The number of raccoons that may be lethally removed by WS would be expected to have minimal effect on the overall raccoon population in Maine. This species is considered widespread and very common throughout most of the State of Maine. Although the number of raccoons lethally removed in the State during the annual harvest seasons for raccoons is unknown, the cumulative take likely represents a small percentage of the overall statewide population. Raccoon populations can remain relatively abundant if annual harvest levels are below 49% (Sanderson 1987). The unlimited take allowed by the MDIFW during the regulated hunting and trapping season for raccoons in the State also provides an indication that statewide densities of raccoons is sufficient to allow unlimited take; therefore, the population is not likely to be overharvested. WS' cumulative lethal removal of up to 300 raccoons would not likely adversely affect raccoon populations in Maine and would not limit the ability to harvest raccoons in the State during the regulated trapping season.

Striped Skunk Population Information and Effects Analysis

Although easily recognized by their black and white fur, the striped skunk may be most readily recognized by the odiferous smell of their musk. They are common throughout the United States and Canada (Rosatte 1987). Striped skunks are primarily nocturnal and do not have a true hibernation period; although, during extremely cold weather, skunks may become temporarily dormant. The striped skunk is an omnivore, feeding heavily on insects such as grasshoppers, crickets, beetles, bees, and wasp (Chapman and Feldhamer 1982). The diet of the striped skunk also includes small mammals and the eggs of ground-nesting birds and amphibians. Striped skunks are typically not aggressive and attempt to flee when approached by humans (Rosatte 1987). However, when provoked, skunks will give a warning and assume a defensive posture prior to discharging their foul-smelling musk. This musk is comprised of sulfur-alcohol compounds known as butylmercaptan (Chapman and Feldhamer 1982).

Adult skunks begin breeding in late February. Yearling females (born in the preceding year) mate in late March. Gestation usually lasts about seven to 10 weeks. Litters commonly consist of five to nine young, with two litters per year possible (Hall and Kelson 1959). The home range of striped skunks is usually not consistent. It appears to be in related to life history requirements, such as winter denning, feeding activities, dispersal, and parturition (Rosatte 1987). During the breeding season, males may travel larger areas in search of females. Skunk densities vary widely according to season, food sources, and geographic area. Densities have been reported to range from one skunk per 77 acres to one skunk per 10 acres (Rosatte 1987).

Population estimates for striped skunks in Maine are currently not available. Striped skunks can be found in a variety of habitats across Maine, especially those influenced by humans. The skunk population in Maine is thought to be stable (J. DePue, MDIFW pers. comm. 2010). To analyze potential impacts of WS' activities on striped skunk populations in Maine, the best available information will be used. The land area of the State of Maine (excluding water) is 30,843 mi^2 or 79,883 km^2 (United States Census Bureau 2010). If only 50% of the land in Maine was sufficient habitat to support striped skunks, and using the lowest estimate of skunk density (3.21 skunks per km^2), a conservative statewide striped skunk population could be estimated at approximately 128,200 skunks. Considering skunks are likely to inhabit urban areas at much higher densities, and they may inhabit more than 50% of the land area in Maine, an estimate of 128,200 skunks is likely low. Similar to other furbearing species, skunks can be found throughout the State and the estimate is intended to evaluate the magnitude of take proposed under this

alternative.

Striped skunks are classified as a furbearer in Maine with a regulated trapping season. During the length of the season, there is no limit on the number of skunks that can be harvested (MDIFW 2012). There are no tagging requirements for striped skunks in Maine; therefore, no harvest information is available. When skunks are involved in property damage or agricultural damage, a landowner or their agent may kill or the landowner may have those skunks causing damage killed by other entities (12 MRSA §12401, 12 MRSA §12402). Skunks are also lethally taken to alleviate damage or threats of damage; however, the exact number of skunks lethally taken annually in the State to alleviate damage or threats of damage is currently unknown.

During previous activities to alleviate or prevent nest predation, WS has lethally removed 50 skunks between FY 2007 and FY 2011, which represents an average of 10 skunks per year. WS has lethally removed 72 skunks total between FY 2007 and FY 2011 during all damage management activities conducted in the State, which represents an average of 15 skunks per year.

Based on previous requests for assistance and in anticipation of additional requests to address nest predation, WS could take up to 50 striped skunks annually to address nest predation. To ensure a cumulative analysis of the potential take of striped skunks for reducing risks of nest predation and other damage management activities conducted by WS throughout Maine, this EA will evaluate the lethal take of up to 100 striped skunks annually; however, take of striped skunks to alleviate nest predation would not exceed 50 striped skunks. Using the lowest population estimate of 128,200 skunks, take of up to 100 skunks would represent 0.08% of the estimated statewide population. As stated previously, the total number of skunks lethally removed during the annual trapping season and to alleviate damage is unknown. If the statewide population were actually greater than the population estimated at 128,200 skunks, any take by WS would represent an even smaller percentage of the actual population. The unlimited take allowed by the MDIFW provides an indication that skunk densities in the State are sufficient to maintain a sustain harvest level and adverse effects from harvest and damage management purposes would not likely cause overharvest of the species leading to population declines.

Coyote Population Information and Effects Analysis

Coyotes are a familiar mammal to most people. Their coloration is blended, primarily gray mixed with a reddish tint. The belly and throat are a paler color than the rest of the body (Beckoff 1982). Coyotes have long, rusty or yellowish legs with dark vertical lines on the lower foreleg. They are similar in appearance to gray and red wolves (National Audubon Society 2000). Color varies greatly; however, coyotes are nearly black to red or nearly white in some individuals and local populations. Most have dark or black guard hairs over their back and tail (Green et al. 1994). They sometimes breed with domestic dogs producing hybrids called "*coydogs*" (National Audubon Society 2000). The size of coyotes varies from about 20 to 40 lbs (9 to 18 kg) (Voigt and Berg 1987).

Coyotes range throughout the United States with the highest densities occurring on the Plains and in the south-central United States, including Texas. The distribution of coyotes in eastern North America began to expand beginning around 1900 to 1920. Now, all eastern states and Canadian provinces have at least a small population of coyotes (Voigt and Berg 1987).

Coyotes often include many items in their diet. Rabbits are one of the most common prey items. Other items in the coyote's diet include carrion, rodents, ungulates (usually fawns), insects (such as grasshoppers), as well as livestock and poultry. Coyotes readily eat fruits such as watermelons, berries, persimmons and other vegetative matter when it is available. In some areas, coyotes feed on human refuse at dumpsites and take small domestic pets, such as cats and dogs (Voigt and Berg 1987).

Coyotes breed between January and March and are able to breed prior to reaching one year of age (Kennely and Johns 1976), but the percentage of yearlings having litters varies from zero to 80% in different populations (Gier 1968). This variation is influenced by a number of factors, which causes large annual variations in the total number of coyotes breeding. In a study in Texas, the percentage of females having litters varied from 48% to 81% (Knowlton 1972). Pups are born after a gestation period of 60 to 63 days, with litter sizes varying primarily with prey availability. Gier (1968) reported average litter sizes of 4.8 to 5.1 in years with low rodent numbers, but litters of 5.8 to 6.2 during years with high rodent numbers. Litter sizes of one to 19 pups have been reported (National Audubon Society 2000).

Many references indicate that coyotes were originally found in relatively open habitats, particularly grasslands and sparsely wooded areas of the western United States. Today, coyotes have adapted to, and now exist in virtually every type of habitat, arctic to tropic, in North America. Coyotes live in deserts, swamps, tundra, grasslands, brush, dense forests, from below sea level to high mountain ranges, and at all intermediate altitudes. High densities of coyotes also appear in the suburbs of major cities (Green and Gipson 1994).

The coyote is probably the most extensively studied carnivore (Bekoff 1982), and considerable research has been conducted on population dynamics. Data from scent-station indices suggest that density increases from north to south. Coyote densities as high as 2 per km^2 (5 per mi^2) have been reported in the southwestern and west-central United States, but are lower in other portions of the country, including eastern North America, although few studies have accurately determined densities (Voigt and Berg 1987). Although coyote densities vary based on local habitat quality, Knowlton (1972) determined that density estimates of 0.5 to 1.0 coyotes per mi^2 would likely be applicable to coyote densities across much of their range. However, methods for estimating carnivore populations are crude and often produce estimates with broad confidence intervals (Crawford et al. 1993).

Because determinations of absolute coyote densities are frequently unknown (Knowlton 1972), many researchers have estimated coyote populations using various methods (Clark 1972, Knowlton 1972, Camenzind 1978, USDI 1979, Pyrah 1984). The cost to accurately determine absolute coyote densities over large areas is prohibitive (Connolly 1992) and would not appear to be warranted given the coyote's overall relative abundance. The presence of unusual food concentrations and the assistance provided to a breeding pair by non-breeding coyotes at the den can influence coyote densities and complicate efforts to estimate abundance (Danner and Smith 1980). Coyote densities are lowest in late winter prior to whelping, highest immediately after whelping, followed by a continued decline to the next whelping season (Parker 1995).

Predator abundance indices suggest that densities of coyotes in North America increase from north to south (Knowlton and Stoddart 1985, Parker 1995). Coyote densities range from 0.2 per square mile when populations are low (pre-whelping) to 3.6 coyotes per square mile when populations are high (post-whelping) (Knowlton 1972, USDI 1979). Although coyote densities vary considerably between habitat types and vary based on numerous environmental variables, Knowlton (1972) concluded that coyote densities might approach a high of five to six coyotes per square mile under extremely favorable conditions with densities of 0.5 to 1.0 per square mile possible over the entire range of the coyote in the United States. Such an estimate is speculative but represents some the best available information for estimating coyote populations.

Coyotes are common throughout the State and inhabit a variety of habitats. In Maine, coyote home ranges have been documented as being much larger, and populations less dense. Harrison (1992) identified coyote home ranges as being similar in three Maine study areas, ranging between 42 km^2 and 49 km^2 (16.2 mi^2 to 18.9 mi^2). The number of coyotes in Maine appears to be determined by the coyote's

space requirements and available habitat (Harrison 1992). Because coyotes are extremely adaptable to a variety of habitat types, it is likely that habitat is not a limiting factor to coyotes in Maine; in fact, high densities of coyotes also appear in the suburbs of major cities (Green and Gipson 1994). Other northeast studies have also documented similar coyote home ranges. In the Adirondacks of New York, where deer densities were estimated to be higher than Maine, the average home range size of coyotes was 38 km^2 (14.7 mi^2) (Brundige 1993).

Consequently, the population size of coyotes in Maine can be determined by the number of territories that can be accommodated by the land area of Maine (or space) and the number of coyotes living in each territory. By using an average home range size, and the amount of suitable habitat in Maine, the MDIFW estimated the December 1 coyote population in the State to be between 10,000 and 12,000 individuals annually based on a stable population trend (Jakubas 1999).

Coyotes are classified as furbearers in Maine, with a regulated trapping season with unlimited take allowed (MDIFW 2010). In addition, coyotes can be lethally taken throughout the year during a continuously open hunting season as well as a 37-week special night hunting season with unlimited take. Additionally, a landowner or their agent may kill or have killed any coyotes that have damaged property, gardens, or homes (12 MRSA §12401, 12 MRSA §12402), and state policy empowers game wardens and biologists to investigate coyote depredations and deploy agents to remove specific coyotes known or suspected of causing agricultural losses. The annual statewide fur harvest of coyotes in Maine has ranged from a low of 1,521 coyotes to a high of 2,459 individuals over the past eight years (see Table 4-1; MDIFW 2010). The number of coyotes lethally removed per year to alleviate damage in the State is currently unknown.

Population modeling information suggests that a viable coyote population can withstand an annual removal of 70% of their population without causing a decline in the population (Connolly and Longhurst 1975, Connolly 1995). The unique resilience of the coyote, its ability to adapt, and its perseverance under adverse conditions is commonly recognized among biologists and land managers. Despite intensive historical damage management efforts in livestock production areas and despite sport hunting and trapping for fur, coyotes continue to thrive and expand their range, occurring widely across North and Central America (Miller 1995). Connolly and Longhurst (1975) determined that, "*...if 75% of the coyotes are killed each year, the population would be exterminated in slightly over 50 years*." However, Connolly and Longhurst (1975) go on to explain that their "*...model suggests that coyotes, through compensatory reproduction, can withstand an annual population mortality of 70%*" and that coyote populations would regain pre-control densities (through recruitment, reproduction, and migration) by the end of the fifth year after control was terminated even though 75% mortality had occurred for 20 years. In addition, other researchers (Windberg and Knowlton 1988) recognized that immigration, (not considered in the Connolly and Longhurst (1975) model) could result in rapid occupancy of vacant territories, which helps to explain why coyotes have thrived in spite of intensive damage management activities (Connolly 1978).

Between FY 2007 and FY 2011, WS has lethally removed five coyotes in Maine to alleviate or prevent nest predation. During all damage management activities, 22 coyotes have been lethally removed by WS between FY 2007 and FY 2011. Based on the number of requests for assistance received previously and based on the number of coyotes addressed as part of those requests for assistance, WS could take up to 20 coyotes annually to alleviate predation or threats. To ensure a cumulative analysis of the potential take of coyotes for reducing risks of nest predation and other damage management activities conducted by WS throughout Maine, this EA will evaluate the lethal take of up to 200 coyotes annually; however, take of coyotes to alleviate nest predation would not exceed 20 coyotes.

Using the conservative estimate of 10,000 coyotes, the lethal removal of up to 200 coyotes under this

project would affect up to 2.0% of the estimated coyote population in Maine based on the 1999 population estimate and a stable population trend. If the highest level of take that occurred during the hunting and trapping seasons for coyotes were added to WS' anticipated take, the cumulative take of 2,659 coyotes would represent 26.6% of the estimated population. Based on the reproductive potential of coyotes and the limited take of 200 coyotes by WS, no effect on coyote populations in Maine would be expected. In addition, WS' removal of up to 200 coyotes would not limit the ability of those persons interested to harvest coyotes during the regulated season in the State.

Red Fox Population Information and Effects Analysis

The red fox is a typically proportioned member of the canid family. The bushy and unusually long tail, pointed ears, slender muzzle, and slanted eyes coupled with its small dog size and typical reddish coloration, make the red fox instantly recognizable to most people. This species is also the most common and well-known species in the genus *Vulpes*, which includes about 10 other species worldwide (Honacki et al. 1982). Typically, black-tipped ears, black cheek patches, white throat parts, a lighter underside, and black "*leg stockings*" are found on most red fox. The white tip of the tail (which is much more prominent in North American fox than elsewhere) can be used to distinguish brownish fox pups from similarly colored coyote pups, which lack a white tail tip (Voigt 1987).

In North America, the red fox weighs about 3.5 to 7 kg (7.7 to 15.4 lbs), with males averaging about 1 kg (2.2 lbs) heavier than females. Generally, adult fox measure 100 to 110 cm (39 to 43 inches) from the tip of the nose to the tip of the tail. Juveniles in their first autumn are similar in size to adults (Voigt 1987). Red fox occur over most of North America. Prehistoric fossil records suggest that the red fox may not have inhabited much of the United States; however, they were plentiful in many parts of Canada. Voigt (1987) has suggested climatic factors, interbreeding with the introduced European red fox, extirpation of the gray and red wolf, and clearing of land for agriculture has possibly contributed to the present-day expansion and range of this species in North America.

Red fox are adaptable to most habitats within their range, but usually prefer open country with moderate cover. Some of the highest fox densities reported are in the north-central United States and occur where woodlands are interspersed with farmlands. Red fox have also demonstrated their adaptability by establishing breeding populations in many urban areas of the United States, Canada, and Europe (Phillips and Schmidt 1994). In many areas, competition with other canids and the availability of suitable year-round food resources limit fox survival. Habitat determines the availability of year-round food resources and the presence or absence of other canids. Because those two factors strongly influence red fox survival, habitat limits fox numbers but seldom limits distribution (Voigt 1987).

Red fox mate from January to March and produce litters of one to 10 kits after a gestation period of 51 to 53 days. They rear young in a maternity den, commonly an enlarged woodchuck or badger den, usually in sparse ground cover on a slight rise, with a good view of all approaches (National Audubon Society 2000). Juvenile fox are able to breed before reaching a year old, but in areas of high red fox densities, most yearlings do not produce pups (Harris 1979, Voigt and MacDonald 1984, Voigt 1987). Gier (1968) reported average litter sizes of 4.8 to 5.1 in years with low rodent numbers, but litters of 5.8 to 6.2 during years with high rodent numbers. Litter sizes of one to 19 pups have been reported (National Audubon Society 2000). Offspring disperse from the denning area during the fall and establish breeding areas in vacant territories, sometimes dispersing considerable distances. Red fox are generally solitary animals as adults, except when mating (Phillips and Schmidt 1994). Rabies and distemper are associated with this species.

The red fox is a skilled nonspecific predator, foraging on a variety of prey. It is also an efficient scavenger, and in parts of the world, garbage and carrion are extremely important to its diet (Voigt 1987).

They are opportunists, feeding mostly on rabbits, mice, bird eggs, insects, and native fruit. They usually kill animals smaller than a rabbit, although fawns, pigs, kids, lambs, and poultry are sometimes taken (Phillips and Schmidt 1994). They also feed on squirrels, woodchucks, crayfish, and even grasses (National Audubon Society 2000).

Population densities are difficult to determine because of the secretive and elusive nature of fox. Estimates are prone to error even in open areas with good visibility. Methods used to estimate numbers have included aerial surveys, questionnaires to rural residents and mail carriers, scent post surveys, intensive ground searches, and indices derived from hunting and trapping harvest (Voigt 1987). Home ranges for red fox in the eastern United States are usually from 500 to 2,000 ha (1,235 to 4,940 acres) in rural settings, such as farmland (Voigt and Tinline 1980), but such sizes may not apply among fox populations in urban settings. In Great Britain, where food is abundant in many urban areas, densities as high as 30 fox per km^2 (78 per mi^2) have been reported (Harris 1977, MacDonald and Newdick 1982, Harris and Rayner 1986), while in southern Ontario, densities of about 1 fox per km^2 (2.6 per mi^2) occur during spring. This includes both pups and adults. In small areas of the best habitat, three times as many fox have been observed (Voigt 1987). However, those densities rarely occur extensively because of the dispersion of unsuitable habitat, high mortality, or from competition with coyotes (Voigt and Earle 1983). Cyclical changes in fox numbers occur routinely and complicate density estimates as well as management. Those cycles can occur because of changes in prey availability, or disease outbreaks, especially rabies, among red fox. For fox populations to remain relatively stable, mortality and reproduction must balance approximately.

Dispersal serves to equalize fox densities over large areas. Annual harvests in localized areas in one or more years will likely have little impact on the overall population in subsequent years, but may reduce localized predation (Allen and Sargeant 1993). Phillips (1970) stated that fox populations were resilient and for fox control (by trapping) to be successful, pressure on the population must be almost continuous. Phillips (1970) and Voigt (1987) also concluded that habitat destruction affects fox populations more than short-term over-harvest.

Red fox are considered widespread and common throughout most of Maine; however, the current statewide population is unknown. In 1985, the red fox population in Maine was estimated at 74,162 fox and was projected to rise to 81,479 by 1990 (Caron 1986). Red fox are classified as furbearers in Maine, with a regulated hunting and trapping season with unlimited take. In addition, a landowner or their agent may kill or have killed foxes that have damaged property, gardens, or homes (12 MRSA §12401, 12 MRSA §12402) after receiving permission from a game warden or regional wildlife biologist. The annual statewide fur harvest of red fox in Maine has ranged from 893 to 1,535 individuals over the past eight years (MDIFW 2011*d*). The number of fox lethally taken annually in the State to alleviate damage or threats of damage is currently unknown.

Between FY 2007 and FY 2011, WS removed 43 red fox to reduce predation risks in the State, which represents an average removal of 8.6 red fox per year. During all damage management activities conducted by WS in Maine from FY 2007 through FY 2011, WS has removed a total of 49 red fox (see Table 4-3), which represents an average removal of 9.8 red fox. Based on the number of requests for assistance received previously and based on the number of red fox addressed as part of those requests for assistance, WS could take up to 30 red fox annually under the proposed action. However, to ensure a cumulative analysis of the potential take of red fox for reducing risks of nest predation and other damage management activities conducted by WS throughout Maine, this EA will evaluate the lethal take of up to 50 red fox annually. Using the 1990 population estimate of 81,479, WS' lethal take of 50 red fox would represent 0.06% of the Maine population. If the highest level of take that occurred during the hunting and trapping season for red fox was added to WS' anticipated take, the cumulative take of 1,585 red fox would represent 2.0% of the estimated population.

Although exact population estimates for red fox in Maine are not available, the unlimited take allowed by the MDIFW for the species during hunting and trapping seasons indicates the species is not at risk of overharvesting. The proposed take of red fox to alleviate damage would be a small component of the overall harvest of red fox in the State. The overall take would be of low magnitude when compared to the statewide population and the number of fox harvested during the annual hunting and trapping seasons. Based on the low magnitude of proposed take, activities conducted under this alternative would not limit the ability to harvest red fox in the State during the hunting and trapping season.

Gray Fox Population Information and Effects Analysis

The gray fox is common in many parts of the United States where deciduous woodlands provide habitat. Yet, this secretive carnivore is seldom seen. This species is somewhat smaller in stature than the red fox, having shorter legs and extremities. Gray fox exhibit striking pelage, which has grizzled upper parts resulting from individual guard hairs being banded with white, gray, and black. A predominance of black-tipped hairs in the middle of the back forms a dark longitudinal stripe that extends into a conspicuous black mane of coarse hair at the top of the black-tipped tail. Portions of the neck, sides, and limbs are cinnamon-colored. The ventral areas of a gray fox are buff colored. White shows on the ears, throat, chest, belly, and back legs, and the black, white, and reddish facial markings provide distinctive accents (Fritzell 1987).

Gray fox adults weigh between 3 to 7 kg (6.5 to 15 lbs), with males being slightly larger than females. Generally, adult gray fox measure 80 to 113 cm (31.5 to 44 inches) from the tip of the nose to the tip of the tail. They inhabit wooded, brushy, and rocky habitats from extreme southern Canada to northern Venezuela and Colombia, excluding portions of the mountainous northwestern United States, the Great Plains, and eastern Central America. Gray fox occur over most of North America, north and east from southern California, Arizona, and central Texas (Fritzell 1987).

Gray fox prefer habitat with dense cover such as thickets, riparian areas, swampland, or rocky pinyon-cedar ridges. In eastern North America, this species is closely associated with edges of deciduous forest. They can also be found in urban areas where suitable habitat exists (Phillips and Schmidt 1994).

Gray fox mate from January through March and produce litters of one to seven kits after a gestation period of 53 days (National Audubon Society 2000). They rear young in a maternity den, commonly located in woodpiles, rocky outcrops, hollow trees, or brush piles (Phillips and Schmidt 1994). The male parent helps tend to the young but does not den with them. The young are weaned at three months and hunt for themselves at four months, when they weigh about 3.2 kg (7 lbs). Rabies and distemper are associated with this species (National Audubon Society 2000).

Accurate estimates of carnivore populations are rare and those for gray fox populations are no exception. Estimates based on knowledge of the species, experience, and intuition may be as accurate as estimates based on recognized methods, such as mark-recapture studies. Published estimates of gray fox density vary from 1.2 to 2.1 per km^2 (3.1 to 5.4 per square mile) depending on location, season, and method of estimation (Errington 1933, Gier 1948, Lord 1961, Trapp 1978). Over areas larger than 5,000 km^2 (1,930 mi^2) in which habitat quality varies, densities are likely lower. Exceptionally high fox densities have been recorded in some situations (Grinnell et al. 1937, Hallberg and Trapp 1984).

Home ranges for gray fox vary throughout the year. Both males and females travel over larger areas during fall and winter, probably in response to increased energy demands and a declining food base (Follmann 1973, Nicholson 1982). During April, when young fox require regular feeding, a female's home range is less extensive than it is without the demands of those young (Follman 1973). Although

exceptions exist, eastern gray fox generally have larger home ranges than western animals (Fritzell 1987). For instance, 16 adult fox were tracked for more than one month in Alabama (Nicholson 1982) and Missouri (Haroldson and Fritzell 1984) and it was determined that they all had home ranges larger than 200 ha (500 acres), and many exceeded 500 ha (1,235 acres).

Gray fox feed on a wide variety of plant and animal matter and are considered to be the most omnivorous of the North American canids (Fritzell 1987). Although active primarily at twilight and at night, the gray fox is sometimes seen foraging by day in brush, thick foliage, or timber. The only American canid with true climbing ability, gray fox occasionally forage in trees and often takes refuge in them, especially leaning or thickly branched trees. The gray fox feeds heavily on cottontail rabbits, mice, voles, other small mammals, birds, insect, and plant material, including corn, apples, persimmons, nuts, cherries, grapes, pokeweed fruit, grass, and blackberries. Grasshoppers and crickets are often a very important part of the diet in late summer and autumn (National Audubon Society 2000).

Current population data for gray fox in Maine is not available. In Maine, gray fox are known to be limited in range to approximately the southern one-third of the State, but there is indication that they are slowly expanding their range northward and their population may be increasing (J. DePue, MDIFW pers. comm. 2010). Furthermore, they are considered common in York, Cumberland, and Sagadahoc Counties in Maine, and ranked as common on the RCNWR (USFWS 2001*a*). Since gray fox are limited to the southern portion of Maine, which includes those areas where ground nesting occurs, population estimates will be restricted to York, Cumberland, and Sagadahoc Counties. There is 1,894 mi^2 of forestland (Griffith and Alerich 1996) and 73 mi^2 of cropland (USDA 2009) in York, Cumberland, and Sagadahoc counties. Using the assumptions that only 75% of the forest and crop lands throughout these counties have sufficient habitat to support gray fox, that gray fox are only found in those habitats, and gray fox densities average 1.2 gray fox per km^2, a three-county gray fox population could be estimated at approximately 4,573 fox. Considering gray fox inhabit a large variety of habitats, including suburban areas, and may occupy more than 75% of the forested and cropland habitat available, an estimate of 4,573 gray fox is likely low. However, similar to the other furbearing species, gray fox occupying only 75% of the land area was used to provide a minimum population estimate to evaluate the magnitude of the proposed take by WS.

Gray fox are classified as furbearers in Maine, with a regulated hunting and trapping season with unlimited take allowed (MDIFW 2011*d*). The annual statewide fur harvest of gray fox in Maine has ranged from 67 to 332 individuals over the past eight years (see Table 4-1; MDIFW 2011*d*). Similar to red fox, a landowner or their agent may kill or have killed any gray fox that have damaged property, gardens, or homes 12 MRSA §12401, 12 MRSA §12402) after receiving specific permission from a game warden or regional wildlife biologist. However, the number of fox lethally taken annually to alleviate damage or threats of damage is currently unknown.

During previous activities, WS has lethally removed 20 gray fox from FY 2007 through FY 2011, which represents an average of four gray fox removed annually to alleviate or reduce nest predation. Furthermore, WS has removed 26 gray fox during all damage management activities in the State (see Table 4-3). To ensure a cumulative analysis of the potential take of gray fox for reducing risks of nest predation and other damage management activities conducted by WS throughout Maine, this EA will evaluate the lethal take of up to 40 gray fox annually; however, take of gray fox to alleviate nest predation would not exceed 20 gray fox. Based on previous requests for assistance and based on receiving additional requests for assistance, WS anticipates that up to 20 gray fox could be removed to alleviate predation risks. If the highest level of take that occurred during the hunting and trapping season for gray fox was added to WS' anticipated take, the cumulative take of 372 gray fox would represent 8.1% of the estimated population.

Since the population of gray fox in those three counties is likely higher than 4,573 fox, WS' take of gray fox would represent a lower percentage of the actual population. Like other mammal species addressed in this EA, the unlimited take allowed by the MDIFW during the hunting and trapping seasons and allowing the take to alleviate damage by the MDIFW provides an indication that gray fox populations maintain sufficient densities within the State to sustain unlimited harvest and that overharvest is unlikely. Thus, the lethal removal of gray fox would be of low magnitude when compared to the estimated gray fox population in Maine and would not limit the ability to harvest gray fox in the State during the regulated trapping season.

Mink Population Impact Analysis

The mink is member of the weasel family and is about 46 to 61 cm (18 to 24 inches) in length, including the somewhat bushy tail. Mink weigh between 0.7 to 1.4 kg (1.5 to 3 lbs). Females are about three-fourths the size of males. Both sexes are a rich chocolate-brown color, usually with a white patch on the chest or chin, and scattered white patches on the belly. The fur is relatively short with the coat consisting of a soft, dense underfur concealed by glossy, lustrous guard hairs. Mink also have anal musk glands common to the weasel family, and can discharge a disagreeable musk if frightened or disturbed (Boggess 1994*b*). They also mark their hunting territory with this fetid musk, which is as malodorous as a skunk's musk, although it does not carry as far (National Audubon Society 2000).

Mink are found throughout North America, with the exception of the desert southwest and tundra areas (Eagle and Whitman 1987). They are shoreline dwellers and their one basic habitat requirement is a suitable permanent water area. This may be a stream, river, pond, marsh, swamp, or lake. They make their dens in muskrat houses, abandoned burrows, holes, crevices, logjams, or abandoned beaver lodges. They are active mainly at night and are active throughout the year, except for brief intervals during periods of low temperature or heavy snow (Boggess 1994*b*). They may adjust hunting times to prey availability (National Audubon Society 2000).

Eagle and Whitman (1987) indicated mink population densities varied spatially based on habitat, and could be influenced temporally by weather, trapping, and intraspecific aggression. Mink are most abundant in those areas with stable aquatic habitat. Mink densities in Louisiana were found to be highest in swamps, followed by marshes, and drained bottomlands (Linscombe et al. 1982). In Montana, 280 mink were found inhabiting a 33 km^2 (12.8 mi^2) area during the initial year of a two-year study, which resulted in a population density of one mink per 11.8 ha (29.2 acres) (Mitchell 1961). However, Mitchell (1961) found only 109 mink in the same area the following year, resulting in a density of one mink per 30.3 ha (74.7 acres). Using mink tracks in snow, Marshall (1936), found 0.6 females in one km^2 (1.5/mi^2) of riverbank with a 1:1 sex ratio following heavy trapping in Michigan. During a study conducted in Iowa from 1933 to 1938, one to five mink families were found inhabiting a 180-ha (450 acres) marsh (Errington 1943). In 1939, Errington (1943) found no families present in the same marsh. Over-trapping was suggested as the reason for the decline in the number of mink families found in the marsh (Errington 1943). Intraspecific aggression between mink may have been the limiting factor for the upper limit of mink present at the marsh (Errington 1943).

At a refuge in Wisconsin, McCabe (1949) estimated 24 mink inhabited 446 ha (1,100 acres) in 1944, which resulted in a density of one mink per 18.8 ha (46.3 acres). Over the next four years (1945 to 1948), McCabe (1949) found the number of mink ranged from seven to 10 individuals at the refuge. McCabe (1949) also suggested that the lower population estimates found after the initial year of the study in 1944 were due to higher levels of mink trapping and excessive poaching along the refuge borders. The number of mink observed during the study conducted by McCabe (1949) at the refuge was inversely related to the duration and depth of snow cover; however, the number observed was poorly related to food availability (rabbits [*Sylvilagus* spp.] and mice [*Peromyscus* spp.]). During a two-year study in Sweden, Gerell

(1971) estimated the number of mink present in a 10,000-ha (25,000 acres) area at 11 and 16, respectively, which resulted in a density of one mink per 909 ha (2,245 acres) during the first year of the study and one mink per 625 ha (1,545 acres) in the second year. Along 1.9 km (1.2 miles) of stream in British Columbia, Ritcey and Edwards (1956) caught 11, six, and five mink over three years, respectively, which were similar densities of 1.5 to 3 mink per km (2.5 to 5 mink per mile) found along the coastal shoreline on Vancouver Island reported by Hatler (1976).

The Maine mink population in 1985 was estimated to be 79,900 individuals prior to the harvest season, and projected to decrease slightly to 77,000 in 1990 (Hunt 1986). However, no current population estimates are available for mink in Maine. Mink are classified as furbearers in Maine with a trapping season (MDIFW 2010). During the open trapping season, there is no limit on the number of mink that can be harvested (MDIFW 2010). The annual statewide fur harvest of mink in Maine has ranged between 904 and 2,280 individuals with 12,092 mink reported harvested from the 2004 to 2011 trapping seasons (see Table 4-1). Between the 2004 and 2011 harvest season, trappers have harvested an average of 1,512 mink per year in the State.

In addition, when mink are involved in property or agricultural damage, a landowner or their agent may kill or have killed those mink causing damage or posing a threat of damage (12 MRSA §12401, 12 MRSA §12402). The number of mink lethally taken by entities other than WS in the State to alleviate damage or threats of damage is unknown.

WS did not receive requests for assistance associated with mink in the State between FY 2007 and FY 2011. Although no previous requests for assistance associated with mink have occurred, mink are known nest predators and could be found in areas where nesting occurs. Based on mink being known nest predators and occurring in areas where nesting could occur, up to 20 mink could be killed by WS each year to address nest predation risks in the State. To ensure a cumulative analysis of the potential take of mink for reducing risks of nest predation and other damage management activities conducted by WS throughout Maine, this EA will evaluate the lethal take of up to 40 mink annually; however, take of mink to alleviate nest predation would not exceed 20 mink.

If WS' take of mink to alleviate damage reached 40 individuals annually and the mink population remains at least stable, the take of 40 mink by WS would represent 0.05% of a mink population estimated at 77,000 mink. If the highest level of take that occurred during the past eight trapping seasons for mink was added to WS' anticipated take of 40 mink, the cumulative take of 2,320 would represent 3.0% of the estimated population. Although the actual statewide population of mink is unknown, the unlimited take allowed by the MDIFW during the annual trapping season provides an indication that the species is not likely to decline from overharvest, including take that occurs from damage management activities.

Long-tailed Weasel Population Impact Analysis

The long-tailed weasel is the largest true weasel in North America and is about 30 to 40 cm (11 to 16 inches) in length, including the slender black-tipped tail that measures 8 to 16 cm (3.2 to 6.3 inches) (Godin 1977). Males are approximately 25% larger than females and weights range between 72 and 267 g (2.5 and 9.3 oz). They exhibit the typical mustelid form, which is a long, slender body with short legs. Weasels are covered in short fur that transitions from brown backs and white bellies to all white with black-tipped tail in the northern latitudes of its range (Palmer 1954). The tail is 44% to 70% of the length of the head and body (Sheffield and Thomas 1997). Long-tailed weasels possess musk glands similar to others members of the weasel family, and will emit a strong and odiferous scent when frightened.

The long-tailed weasel has the widest distribution of any mustelid in the Western Hemisphere from Canada south to Venezuela, Ecuador, Peru, and Bolivia (Godin 1977, Eisenberg 1989, King 1989,

Emmons and Feer 1990). Weasels utilize a variety of habitats, but prefer open woodlands, brushlands, or rocky areas near wetlands. Long-tailed weasels are active in both winter and summer. In addition, peak activity occurs during the day when sunlight is at its height (Chapman and Feldhamer 2003). The long-tailed weasel inhabits all life zones, with the exception of desert throughout its range (Burt and Grossenheider 1952, Hall 1981). They use burrows, or naturally existing crevices or holes to escape the elements, rest, and to raise their young.

They construct loose nests with the remains of their prey (Palmer 1954). Long-tailed weasels breed in July and August, but implantation is delayed for over seven months. Long-tailed weasels have single annual litters averaging four to five with a maximum of nine after a 205- to 337-day gestation period due to delayed implantation of embryos. The young are typically born in April or May.

Between 50% and 80% of the yearly food intake of weasels consists of small mammals, especially rodents. In particular, long-tailed weasels prefer voles, cottontail rabbits, mice, rats, shrews, squirrels and chipmunks (Hamilton, Jr. 1933). They will vary their diet based on season, availability, and individual preferences. Despite altered diets, long-tailed weasel population densities fluctuate considerably with year-to-year changes in small mammal abundances (MacLean et al. 1974, Fitzgerald 1977). Long-tailed weasel population densities range from as low as 0.004 to as high as 0.38 per ha (Glover 1943, Quick 1951) and populations occasionally crash, requiring several years to recover (Osgood 1935). In the scrub oak/pitch pine forests of Pennsylvania, Glover (1942) documented long-tailed weasels occurring in a density of 12 per 100 ha (31.1 per mi^2), and in Michigan farmland, Allen (1938) documented a density of three per 100 ha (7.8 per mi^2) (King 1989). In favorable habitat, maximum densities of long-tailed weasel may reach 40 to 47 animals per square kilometer (16 to 18 per square mile) (Henderson 1994). In general, the long-tailed weasel has a home range of 12 to 16 ha (29 to 40 acres) and males have larger home ranges than females during the summer (Svendsen 1990).

Population estimates for long-tailed weasels in Maine are currently not available. Long-tailed weasels can be found in a variety of habitats across Maine, and the population is thought to be stable (J. DePue, MDIFW pers. comm. 2010). To analyze potential impacts of WS' activities on long-tailed weasel populations in Maine, a population estimate will be derived to provide context to the estimated take levels that could occur annually to alleviate nest predation threats. The land area of the State of Maine (excluding water) is 30,843 mi^2 (United States Census Bureau 2010). If only 50% of the land in Maine was sufficient habitat to support long-tailed weasels, and using only 25% of the lowest long-tailed weasel density reported by Henderson (1994) (16 per mi^2), a conservative statewide long-tailed weasel population could be estimated at approximately 61,700 weasels. Considering the adaptability of long-tailed weasels, and the fact that they use a wide variety of habitats, and are likely to be present in higher densities, an estimate of 61,700 long-tailed weasels is likely low.

Long-tailed weasels are classified as a furbearer in Maine with an annual regulated trapping season that allows an unlimited number of weasels to be harvested during the length of the season (MDIFW 2011*d*). There are no tagging requirements for long-tailed weasels in Maine, and therefore, no harvest information is available. When weasels are involved in property or agricultural damage, a landowner or their agent may kill or have killed those weasels that are causing damage or posing a threat of damage (12 MRSA §12401, 12 MRSA §12402).

During efforts conducted to reduce predations risks associated with long-tailed weasels, WS has lethally removed five long-tailed weasels from FY 2007 through FY 2011. No other long-tailed weasels were lethally removed by WS in the State during the same period. Based on previous requests for assistance and in anticipation of receiving additional requests for assistance, up to 10 long-tailed weasels could be lethally removed by WS under the proposed action alternative. To ensure a cumulative analysis of the potential take of long-tailed weasels for reducing risks of nest predation and other damage management

activities conducted by WS throughout Maine, this EA will evaluate the lethal take of up to 20 long-tailed weasels annually; however, take of long-tailed weasels to alleviate nest predation would not exceed 10 long-tailed weasels.

Using the population estimate of 61,700 individuals, take of up to 20 long-tailed weasels annually would represent 0.03% of the estimated population in Maine. Although the number of long-tailed weasels lethally taken to alleviate damage and the number harvested during the annual trapping season are unknown, the cumulative take would not likely reach of magnitude where declines would occur from those activities. The unlimited take allowed by the MDIFW during the annual trapping season provides an indication that long-tailed weasel populations are sufficient to sustain that level of take and that overharvest is not likely to occur.

Short-tailed Weasel Population Impact Analysis

The short-tailed weasel, or ermine as they are sometimes known, is a member of the weasel family (Mustelidae) and ranges in length from 19 to 30 cm (7.5 to 11.8 inches) with a tail measuring 4 to 8 cm (1.6 to 3.2 inches) (Godin 1977). Males are approximately 25% larger than females and weights range between 45 and 105 g (1.6 and 3.7 oz). Short-tailed weasels are short-legged, slim mammals that are covered in short fur that transitions from brown backs and white bellies to all white with black-tipped tail in nearly all of its range except from southern British Columbia to California (Palmer 1954). Short-tailed weasels possess musk glands similar to others members of the weasel family, and will emit a strong and odiferous scent when frightened.

Short-tailed weasels are circumpolar in distribution, ranging throughout Canada and into the United States to the southern Rocky Mountains, Minnesota, and Maryland (Godin 1977). These animals utilize a variety of habitats and prefer field borders, open woodlands, and brushy or rocky areas. They use burrows from chipmunks, or naturally existing crevices or holes to escape the elements, rest, and to raise their young. They construct nests with debris and the remains of their prey (Palmer 1954). Short-tailed weasels breed in July and August, but implantation is delayed. Gestation is approximately 9.5 months, and the young are typically born in April or May.

Few studies estimate population size and density for short-tailed weasels in North America. However, it has been documented that home range sizes and population densities of weasels vary with habitat, season, and food availability, and that short-tailed weasels may exist in densities as high as 54 per square kilometer (21 per square mile) (Henderson 1994). In Ontario, Simms (1979) identified short-tailed weasel density from six to 10 per 100 ha (15.5 to 25.9 per mi^2) depending on habitat type (King 1989). The short-tailed weasel is found in nearly all possible land habitats (Burt and Grossenheider 1952).

Population estimates for short-tailed weasels in Maine are currently not available. Short-tailed weasels can be found in a variety of habitats across Maine, and the population is thought to be stable (J. DePue, MDIFW pers. comm. 2010). To evaluate the magnitude of take that could occur to reduce predation risks, a population estimate will be derived using available information. The land area of the State of Maine (excluding water) is 30,843 mi^2 (United States Census Bureau 2010). If only 50% of the land area in Maine was sufficient habitat to support short-tailed weasels, and using only 25% of the highest short-tailed weasel density reported by Henderson (1994) (21 per mi^2), a conservative statewide short-tailed weasel population could be estimated at approximately 81,000 weasels. Considering the adaptability of short-tailed weasels, and the fact that they use a wide variety of habitats, and are likely to be present in higher densities, an estimate of 81,000 short-tailed weasels is likely low.

Short-tailed weasels are classified as a furbearer in Maine that can be harvested during an annual trapping season that allows an unlimited number to be harvested during the length of the season (MDIFW 2011*d*).

There are no tagging requirements for short-tailed weasels in Maine, and therefore, no harvest information is available. Similar to other furbearing species addressed, when weasels are involved in property or agricultural damage, a landowner or their agent may kill or have killed those weasels causing damage or posing a threat of damage (12 MRSA §12401, 12 MRSA §12402).

During activities conducted by WS from FY 2007 through FY 2011 to address nest predation risks, WS has removed one short-tailed weasel. No other lethal take of short-tailed weasels has occurred by WS. Short-tailed weasels are known nest predators and could occur in areas where nesting occurs. In anticipation of the need to address short-tailed weasels, WS could lethally remove up to 10 weasels per year under the proposed action alternative. To ensure a cumulative analysis of the potential take of short-tailed weasels for reducing risks of nest predation and other damage management activities conducted by WS throughout Maine, this EA will evaluate the lethal take of up to 20 short-tailed weasels annually; however, take of short-tailed weasels to alleviate nest predation would not exceed 10 short-tailed weasels. Using the population estimate of 81,000 individuals, take of up to 20 short-tailed weasels annually would represent 0.03% of the estimated population in Maine. Although the number of long-tailed weasels lethally taken to alleviate damage and the number harvested during the annual trapping season are unknown, the cumulative take would not likely reach of magnitude where declines would occur from those activities. The unlimited take allowed by the MDIFW during the annual trapping season provides an indication that short-tailed weasel populations are sufficient to sustain that level of take and that overharvest is not likely to occur.

Feral and Free Ranging Domestic Cats Population Impact Analysis

Feral cats are domesticated cats living in the wild. Free-ranging cats are those cats that are considered to belong to, possessed, or otherwise owned by a person, but are allowed the ability to wander freely within the environment. In general, most feral cats are small in stature, weighing from three to eight pounds (1.4 to 3.6 kg), standing eight to 12 inches (20 to 30.5 cm) high at the shoulder, and 14 to 24 inches (35.5 to 61 cm) long. The tail adds another 20 to 30.5 cm (8 to 12 inches) to their length. Colors range from black to white to orange, and a variety of combinations of those colors. Other hair characteristics also vary greatly (Fitzwater 1994). Other cats that are not considered feral, but may be considered free ranging are capable of attaining much higher weights.

Feral cats are typically found in commensal relationships wherever people are found. In some urban and suburban areas, cat populations equal human populations. In many suburban and eastern rural areas, feral cats are the most abundant predators. They are opportunistic predators and scavengers that feed on rodents, rabbits, shrews, moles, birds, insects, reptiles, amphibians, fish, carrion, garbage, vegetation, and leftover pet food (Fitzwater 1994).

Feral cats produce two to 10 kittens during any month of the year. An adult female may produce three litters per year where food and habitat are sufficient. Cats may be active during the day but typically are more active during twilight or night. House cats have been reported to live up to 27 years, but feral cats probably average only three to five years. They are territorial and move within a home range of roughly 4 km^2 (1.5 mi^2). After several generations, feral cats can be considered completely wild in habits and temperament (Fitzwater 1994).

Feral and free-ranging domestic cats are exotic species to North America. Exotic species are recognized as one of the most widespread and serious threats to the integrity of native wildlife populations and natural ecosystems. Exotic species present special challenges for wildlife managers because their negative effects are poorly understood by the general public, many exotic species have become such an accepted component of the environment that many people regard them as "*natural*", some exotic species have advocacy groups that promote their continued presence, and few policies and laws deal directly with

their control. Perhaps no issue has captured more of the challenges for contemporary wildlife management than the impacts of feral or free-ranging human companion or domestic animals. The domestic cat is the companion animal that recently has attracted the most attention for its impact on wildlife species (The Wildlife Society 2010).

Where it has been documented, the impact of feral and free ranging cats on wildlife populations in suburban and rural areas, directly by predation, and indirectly by competition for food, has been enormous (Coleman and Temple 1989). In the United Kingdom, one study determined that house cats might take an annual toll of some 70 million animals and birds (Churcher and Lawton 1987). American birds face an estimated 117 to 157 million exotic predators in the form of free-ranging domestic cats, which have been estimated to kill at least one billion birds every year in the United States. Cats have contributed to declines and extinctions of birds worldwide, with feral cats considered one of the most important drivers of global bird extinctions (Dauphine and Cooper 2009). In addition, feral cats serve as a reservoir for human and wildlife diseases, including cat scratch fever, distemper, histoplasmosis, leptospirosis, mumps, plague, rabies, ringworm, salmonellosis, toxoplasmosis, tularemia, and various parasites (Fitzwater 1994).

The number of feral and free-ranging cats in Maine is unknown. Because feral and free-ranging cats are considered a detriment to native wildlife species, removing cats could be considered as providing a benefit to the native environment by eliminating predation and competition from an exotic species. WS has not addressed feral cats during previous activities to address nest predation in the State (see Table 4-3).

However, WS may be requested to address nest predation associated with feral or free-ranging cats under the proposed action alternative. In anticipation of receiving requests for assistance, WS could address up to 20 feral or free-ranging cats annually to alleviate nest predation. When targeting feral cats, WS would only employ live-capture methods, primarily cage traps. All cats live-captured would be transported by WS to the local wildlife shelter where animals with no identification (*e.g.*, rabies tag, collar) would be evaluated by the staff of the shelter to determine their adoptability. If cats live-captured were identifiable, the animal shelter would be responsible for locating and notifying the pet owner. If the staff of the animal shelter determines that a cat captured was not adoptable, then that animal would be humanely euthanized by the shelter. After relinquishing the feral cats to a local animal control facility, the care and the final disposition of the cat would be the responsibility of the animal shelter. No intentional lethal take of feral or free-ranging cats would occur by WS under the proposed action alternative. Based upon the above information, WS' capture and relinquishing of cats to a shelter would not have negative effects on local or statewide populations of this species in Maine.

Feral and Free Ranging Domestic Dogs Population Impact Analysis

Feral dogs are domesticated dogs living in the wild. Free-ranging dogs are those dogs that are considered to belong to, possessed, or otherwise owned by a person, but are allowed the ability to wander freely within the environment. Like domestic cats, feral dogs manifest themselves in a variety of shapes, sizes, colors, and even breeds. McKnight (1964) noted German shepherds, Doberman pinschers, and collies as breeds that often become feral. Most feral dogs today are descendants of domestic dogs that appear similar to dog breeds that are locally common (Green and Gipson 1994). The primary feature that distinguishes feral from domestic dogs is the degree of reliance or dependence on humans, and in some respect, their behavior toward people. Feral dogs survive and reproduce independently of human intervention or assistance. While it is true that some feral dogs use human garbage for food, others acquire their primary subsistence by hunting and scavenging like other wild canids.

Feral and domestic dogs often differ markedly in their behavior toward people. Scott and Causey (1973)

based their classification of those two types by observing the behavior of dogs while confined in cage traps. Domestic dogs usually wagged their tails or exhibited a calm disposition when a human approached; whereas, most feral dogs showed highly aggressive behavior, growling, barking, and attempting to bite. Some dogs were intermediate in their behavior and could not be classified as either feral or domestic based solely on their reaction to humans.

Feral dogs are usually secretive and wary of people. Thus, they are active during dawn, dusk, and at night, much like other wild canids. They often travel in packs or groups and may have rendezvous sites, similar to wolves. Travel routes to and from gathering sites or den sites may be well defined. Food scraps and other evidence of concentrated activity may be observed at gathering sites.

The State of Maine does not appear to have a problem with the occurrence of feral dogs, but it is fully possible that this could occur in the future. In Maine, all dogs are required to be registered. Registration fees provide a funding source for municipalities and other jurisdictional governments to enforce dog licensing and to capture dogs that become strays before they become feral. However, in terms of protecting T&E species, domestic dogs have been implicated in a variety of situations that resulted in profound negative effects of nesting shorebirds. Specifically, domestic dogs have been responsible for killing individual piping plovers and terns, as well as causing disturbance that resulted in abandonments of nests and/or young (MDIFW, unpublished data).

If feral dogs exist in an area, they are often found in forested areas or shrublands near human habitation. Some people will not tolerate feral dogs in close proximity to human activity; thus, they take considerable effort to eliminate them in such areas. Feral dogs may be found on lands where human access is limited, such as military reservations and large airports. They may also live in remote sites, where they feed on wildlife and native fruits. The only areas that do not appear to be suitable for feral dogs are places where food and escape cover are not available, or where large native carnivores, particularly wolves, are common and prey on dogs (Green and Gipson 1994).

To date, WS in Maine has not been requested to respond to an incident involving feral or free-ranging dogs; however, it is possible, that if a dog were found in or near shorebird nesting habitat, that WS could be requested to remove those dogs. As a matter of WS' policy in Maine, any incidents involving feral or free-ranging dogs would be handled cooperatively with program participants, area animal control officers, and Maine game wardens. In addition, when requests for assistance were received to alleviate predation or risks of predation associated with feral or free-ranging dogs, only non-lethal methods would be employed by WS. When the removal of feral dogs was deemed appropriate to alleviate predation or reduce predation risks associated with feral dogs under the proposed action alternative, only live-capture methods would be employed (*e.g.*, foot-hold traps, cage traps, cable restraints). Requests for assistance associated with a domestic dog would be handled on a case-by-case basis, with WS relying upon the decisions made by the appropriate regulatory authority (*e.g.*, animal control officer, local police, game warden). If WS was requested to use live capture techniques and subsequently captures a dog, those dogs captured either would be relinquished to the proper authority on site, or would be transported by WS in appropriate animal transport crates to a local animal shelter.

In cases of overly aggressive dogs, WS would request assistance from local animal control, wardens, and/or police. If WS transports dogs, the dogs would be immediately delivered and relinquished to the animal control or pet shelter facility. In cases when the dog owner could be identified, WS would either relinquish the dog to the pet owner or to the responsible authority. In addition, WS would distribute educational information relative to nesting T&E species to those pet owners. Once dogs were relinquished by WS, the local animal control officer or animal shelter would be responsible for the care and disposition of the dog.

No intentional lethal take of feral dogs would occur by WS under the proposed action. In anticipation of receiving requests for assistance associated with feral dogs when alleviating or reducing risks of nest predation, up to five feral dogs could be live-captured and relinquished to a local animal control officer or animal shelter per year under the proposed action.

Eastern Chipmunk Population Impact Analysis

The eastern chipmunk is a ground-dwelling squirrel, typically 13 to 15 cm (5 to 6 inches) long and weighing 90 g (3 oz). Their tail is eight to 10 cm (3 to 4 inches) long and hairy, but it is not bushy (Williams and Corrigan 1994). They have black and white facial stripes, and five dark stripes separated by four pale ones, on the back and sides of their bodies. Chipmunks have large, fur-lined internal cheek pouches for carrying nuts and seeds. Chipmunks cache a great deal of food in the form of seeds, nuts, fruits, and sometimes, green vegetation and insects. They hibernate in the winter, but awaken about every two weeks to feed, since they do not store body fat before hibernation. Chipmunks use a variety of habitats including open deciduous forest with thick understory, rocky ledges with brushy cover, loose stonewalls in rocky hillsides, old forests without understory, old farm woodlots, cutover land, old buildings, parks, and gardens (Godin 1977).

They are daytime animals, and are usually most active in early morning and late afternoon. Chipmunks consume seeds, nuts, berries, mushrooms, insects, and carrion. They are well known for their caching behavior, and chipmunks will often climb trees to reach mast. Chipmunks also prey on small birds and bird eggs (Williams and Corrigan 1994), and they have been identified as an important nest predator (Reitsma et al. 1990). They live mostly on the ground, but their nests may be either an underground burrow, or a hollow tree limb (National Audubon Society 2000). Burrows are often well hidden near objects, such as stumps, woodpiles, brush piles, basements, and garages or other buildings. The burrow entrance is usually about five cm (2 inches) in diameter with no obvious mounds of soil around them (Williams and Corrigan 1994, National Audubon Society 2000). Their dens consist of a complex of underground tunnels consisting of a nesting chamber, one or two food storage chambers, various side pockets, and separate escape tunnels (Williams and Corrigan 1994). Chipmunks can be found across most of the eastern United States, except the extreme south and along the southeastern seaboard (Williams and Corrigan 1994, National Audubon Society 2000).

Eastern chipmunks have two mating periods; those being during early spring and again during the summer or early fall. There is a 31-day gestation period, producing two to five young (Williams and Corrigan 1994). First year females not breeding in early spring may produce litters in late July or August (National Audubon Society 2000). The young are sexually mature within one year. Adults may live up to three years (Williams and Corrigan 1994).

In New York, Yerger (1953) calculated the average home range to be 0.37 acres for adult males, and 0.26 acres for females. Nupp and Swihart (1998) calculated eastern chipmunk density to be 5.5 per ha in forest fragments. Population densities of eastern chipmunks typically are five to 10 animals per hectare (2 to 4 per acre) (Burt and Grossenheider 1976), and may be as high as 24 chipmunks per hectare (10 per acre) if sufficient food and cover are available. Home ranges often overlap among individuals and are usually less than 92 m (100 yards) across (Williams and Corrigan 1994).

Throughout their North American range, chipmunks are considered minor agricultural pests. Most conflicts with chipmunks are nuisance problems. However, when chipmunks are present in large numbers they can cause structural damage by burrowing under patios, stairs, retention walls, or foundations. They may also consume flower bulbs, seeds, or seedlings as well as birdseed, grass seed, and pet food that is not stored in rodent-proof storage containers. For this reason, chipmunks are classified as a "*home and garden*" damage species by MDIFW, and when involved in property or

agricultural damage, a landowner or their agent may kill or have killed those chipmunks causing damage or posing a threat of damage (12 MRSA §12401, 12 MRSA §12402) without permission from a game warden or regional wildlife biologist.

High densities of chipmunks exist in many of the coastal areas where piping plovers and least terns nest. Observers have commonly witnessed chipmunks within nesting areas, and least terns often exhibit mobbing behavior towards them (L. Minich-Zitske, Maine Audubon pers. comm. 2012; K. O'Brien, USFWS pers. comm. 2012). In addition, chipmunks are often thought be responsible for nest predation in those situations where there is a lack of evidence from other nest predators (*e.g.*, tracks, scat).

Population estimates for eastern chipmunks in Maine are currently not available. To analyze potential impacts of WS' activities on eastern chipmunk populations in Maine, the best available information will be used to estimate a statewide population. The land area of the State of Maine (excluding water) is 30,843 mi^2 (United States Census Bureau 2010). If only 25% of the land area in Maine provided sufficient habitat to support chipmunks, and using an average reported estimate of chipmunk density of two per acre, a conservative statewide eastern chipmunk population could be estimated at approximately 9.9 million chipmunks. Considering eastern chipmunks are likely to inhabit more than 25% of the State, an estimate of 9.9 million eastern chipmunks is likely low.

Between FY 2007 and FY 2011, WS has employed lethal methods to remove 75 chipmunks in the State during activities to reduce nest predation risks. No additional take occurred within the State by WS from FY 2007 to FY 2011 (see Table 4-3). Based on previous activities conducted by WS and in anticipation of receiving additional requests for assistance, up to 75 chipmunks could be lethally removed by WS annually to alleviate predation risks on nesting beaches. To ensure a cumulative analysis of the potential take of eastern chipmunks for reducing risks of nest predation and other damage management activities conducted by WS throughout Maine, this EA will evaluate the lethal take of up to 175 eastern chipmunks annually; however, take of chipmunks to alleviate nest predation would not exceed 75 chipmunks. Based on a population estimated at 9.9 million chipmunks, take of up to 175 chipmunks annually by WS would represent 0.002% of the estimated population. The number of chipmunks lethally removed annually by other entities to alleviate damage is unknown; however, take by other entities to alleviate damage caused by chipmunks is not likely to reach a magnitude where adverse effects would occur to the statewide population.

American Crow Population Impact Analysis

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

As discussed previously, blackbirds, including crows, can be taken without the need for a depredation permit issued by the USFWS when blackbirds are committing or when blackbirds are about to commit

damage under the blackbird depredation order (see Chapter 1). In addition, when blackbirds are posing a threat to human safety, blackbirds can be taken under the blackbird depredation order without the need for a specific depredation permit. In addition, crows can be harvested in the State during a regulated season that allows an unlimited number of crows to be harvested during the length of the season. Since take of crows can occur without a permit from the USFWS under the blackbird depredation order, there have been no reporting requirements for the take of crows to reduce damage or reduce threats. Therefore, the number of crows taken in the State under the depredation order to alleviate damage or reduce threats is unknown. Similarly, hunters harvesting crows during the regulated hunting season are not required to report their take to the USFWS or the MDIFW; therefore, the number of crows harvested annually in the State is unknown.

From FY 2007 through FY 2011, WS addressed damage or reduced threats associated with 7,570 American crows. Of those 7,570 crows addressed by WS, 70 crows were lethally taken to alleviate damage or threats while 7,500 crows were addressed using non-lethal methods. As discussed previously, crows can be taken under the blackbird depredation order to alleviate damage or threats. However, the number of crows lethally taken during the hunting season and the number lethally taken to alleviate damage is currently unknown. The highest level of crow take by WS occurred in FY 2010 when 29 crows were addressed using lethal methods in the State. WS addressed 7,500 crows in FY 2009 using non-lethal methods. Based on previous requests for assistance and in anticipation of receiving additional requests for crow damage management, up to 200 American crows could be lethally taken annually by WS to alleviate nest predation in the State.

In addition to nest predation, American crows are also responsible for causing damage to agricultural resources, other natural resources, property, and posing threats to human safety. Based on previous requests for assistance received by WS, the cumulative take of crows by WS, including crows that could be taken to alleviate nest predation, would not exceed 2,000 crows annually during all damage management activities. To ensure a cumulative analysis of the potential take of crows to alleviate damage and to reduce risks of nest predation, this EA will evaluate the lethal take of up to 2,000 crows annually; however, take of crows to alleviate nest predation would not exceed 200 crows.

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, National Audubon Society 2000). 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, National Audubon Society 2000). BBS trend data from 1966 to 2010 indicates that American crow populations have been increasing throughout the United States, the Eastern BBS region, and Maine at an annual rate of 0.5%, 0.5%, and 1.7%, respectively (Sauer et al. 2011). The number of crows observed during winter surveys has shown a general increasing trend in the State (National Audubon Society 2010). Rich et al. (2004) estimated the breeding American crow population in Maine to be 270,000 individuals. Therefore, the potential take by WS of up to 2,000 crows would represent 0.7% of the estimated breeding crow population in Maine. Based upon population trend data, the wide abundance of this bird species and WS' lethal management actions potentially representing 0.7% of the estimated statewide population, WS' management actions would be of low magnitude if take reached 2,000 crows.

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-harvest by restricting take (either through hunting season regulation and/or permitted take) to ensure that annual harvests are within allowable harvest levels. The take of crows under the depredation order by other entities is likely to be a small contributor to the cumulative take of crows annually. Although some take is likely to occur, take is not expected to reach a high magnitude. Similarly, the take of crows during the

annual hunting season is likely of low magnitude when compared to the statewide population. Given that the number of American crows observed during statewide surveys are showing increasing trends (National Audubon Society 2010, Sauer et al. 2011), the population of crows has not declined since those population estimates were calculated. Therefore, the statewide population 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.

American Kestrel Population Impact Analysis

The American kestrel is the smallest, most abundant, and most widespread species in the falcon family (Falconidae). American kestrels differ in color by gender. Males have blue-gray wings and a rufous tail with a single black band while females possess rufous-colored backs and wings with black bars (Smallwood and Bird 2002). American kestrels range throughout North America with the exception of the arctic areas and the Pacific Northwest, and extend into Central and South America. These birds use a wide variety of habitat types including many types of human-influenced environments such as pastures, golf courses, agricultural fields, parks, and urban areas (Elphick et al 2001). Kestrels are capable of breeding as yearlings, of which about 80% do so. Average clutch size is most often four to five eggs, with an estimated 67% reproductive success (at least one fledgling) across their range. Double clutches occur occasionally with occurrences more common in their southern range (Smallwood and Bird 2002).

According to trend data available from the BBS, American kestrels are showing a declining trend in Maine estimated at -5.4% annually since the BBS was initiated in 1966 (Sauer et al. 2011). Kestrels observed on BBS routes in the eastern United States have also shown a declining trend estimated at -2.0% annually with a -0.9% decline estimated for kestrels across all BBS routes in the United States (Sauer et al. 2011). Trend data available from the CBC also indicates a declining trend in the number of kestrels wintering in Maine (National Audubon Society 2010). The breeding population of kestrels in Maine has been estimated at 9,000 birds with the breeding population across the United States estimated at nearly 2.9 million individuals (Rich et al. 2004). Information from the MDIFW substantiates the apparent declining trend observed during the BBS (C. Todd, MDIFW pers. comm. 2010); although, kestrels continue to be very common in the State. Additionally, information from the Breeding Bird Atlas Explorer project indicates that American kestrels have been documented breeding throughout the State based on confirmed locations in 103 of 626 total blocks (156 blocks contained evidence) (Breeding Bird Atlas Explorer 2010).

American kestrels have been identified as potential predators to both young and adult T&E waterbirds. In addition, WS has also received requests for assistance associated with kestrels posing aircraft strike risks at airports in the State. The WS program in Maine has previously employed non-lethal methods to address those requests for assistance to alleviate predation risks and damage threats at airports. Between FY 2007 and FY 2011, three kestrels have been captured and translocated by WS in the State. There has been no lethal take of kestrels by WS in Maine. According to the USFWS, no kestrels were lethally taken by any entities in the State of Maine between 2007 and 2011. However, the USFWS authorized the take of 30 kestrels by other entities in Maine during the same period.

To alleviate threats of predation on T&E species associated with kestrels, WS anticipates that up to five kestrels could be live-captured using bal-chatri traps, pole traps, or Swedish Goshawk traps and translocated from areas where nesting occurs by plovers and terns. All kestrels live-captured in traps would be translocated to an area not less than 50 miles away and released into appropriate habitat. In addition, kestrels captured and translocated could be banded for identification purposes using United States Geological Survey approved metal leg-bands appropriate for the species. Banding would occur pursuant to a banding permit issued by the United States Geological Survey. Fair et al. (2010) stated "[w]*hen appropriate* [leg] *band sizes are used, the occurrence and rate of adverse effects on the subjects*

is ordinarily very low". As a condition of WS' depredation permit issued by the USFWS, any translocation of raptors would be coordinated and/or approved with the MDIFW. If translocation sites could not be located, kestrels live-captured could be relinquished to licensed bird rehabilitators to hold in captivity until after young T&E waterbirds have fledged and left the nesting area. The licensed bird rehabilitators would be responsible for the care and release of the kestrels back into the wild after the nesting season.

As discussed previously, kestrels have been identified as strike hazards at airports within the State and WS could receive requests for assistance to alleviate those threats. Based on previous requests for assistance associated with kestrels posing strike risks at airports, WS could lethally remove up to 20 kestrels annually in the State to address those requests for assistance. However, no lethal take of kestrels would occur to alleviate nest predation. The lethal take of kestrels to alleviate strike risks at airports is discussed here to ensure activities are evaluated cumulatively.

The best available information estimated the statewide breeding population of American kestrels at 9,000 birds (Rich et al. 2004). Based on the best available population estimate, the cumulative take of up to 20 American kestrels to alleviate aircraft strike risks would represent 0.2% of the estimated statewide breeding population. Although the live-capture and translocating of kestrels would be a non-lethal method of reducing predation risks, kestrels could be translocating during their nesting season which could lower nesting success. Eggs are generally observed in nests of kestrels beginning at the very end of March through mid-June with the peak period occurring from early April through mid May (Smallwood and Bird 2002). Nestlings are generally present in nests from early May through late August, with the peak occurring from the end of May through the end of July (Smallwood and Bird 2002).

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

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

The average clutch size for breeding pairs of kestrels is four to five eggs, with a range of one to seven eggs. If the live-capture and translocation of five kestrels resulted in five failed nests, the maximum number of fledglings produced in the State would be reduced by 35 kestrels if no other factors were considered. However, the annual reproductive success rate (*i.e.*, the percentage of nesting attempts that result in at least one fledgling) has been shown to be highly variable, but a 67% success rate is generally estimated for wild populations (Smallwood and Bird 2002). The rate of egg hatching has ranged from 62% to 89%, with nearly 90% of hatchlings reaching the fledgling stage (Smallwood and Bird 2002). In addition, 63% to 69% of first-year kestrels do not survive their first winter (Smallwood and Bird 2002). Re-nesting also occurs in kestrels.

Combining the estimated lethal take of kestrels to alleviate strike hazards at airports and the maximum number of kestrels that could be prevented from fledging by translocating adults to alleviate nest predation, the cumulate take would represent 0.6% of a statewide breeding population estimated at 9,000

kestrels. However, since nesting success rates vary under normal conditions, the translocation of adult kestrels and any subsequent nest failures that result from the translocation would likely represent a lower percentage of the estimated breeding population.

The take of kestrels, including live-capture and translocation, can only occur when permitted by the USFWS pursuant to the MBTA through the issuance of depredation permits. Therefore, all take, including take by WS, would have to be authorized by the USFWS and would occur at the discretion of the USFWS. The take of American kestrels would only occur at levels authorized by the USFWS, which ensures cumulative take would be considered as part of population management objectives for American kestrel in the State.

Merlin Population Impact Analysis

The merlin is a small falcon that resembles the American kestrel, but is slightly larger. The plumage of adult merlins varies by gender, with males exhibiting gray coloration on the back with rufous-colored feathers on the sides of breast and legs. Females are significantly larger than males and have brown backs (Warkentin et al. 2005). Merlins exist in both boreal and temperate forests of Canada and the northern United States. They range throughout much of the forested regions of Canada, southeast to Maine, and across the northern tier states to the west coast of Washington (Warkentin et al. 2005).

In its breeding range, merlins often use semi-open areas, probably to facilitate hunting. Boreal merlins usually nest near forest openings such as those that exist near wetlands or disturbed areas. Wintering habitat of merlins is poorly documented; however, preferred winter habitat appears to be similar to their preferred breeding habitat (*e.g.*, open forest and grasslands). Merlins regularly hunt prey such as shorebirds that are concentrated on tidal flats or other areas where prey are highly abundant (Warkentin et al. 2005). They primarily prey upon birds, but merlins will also consume small mammals, amphibians, snakes, and insects (Bent 1961).

Primarily monogamous, merlins raise one brood each breeding season, laying eggs in the abandoned nests of crows or hawks. The most common clutch size is four to five eggs, and fledging occurs, on average, 29 days after hatching. Merlins are short lived, with their lifespan seldom exceeding eight years (Warkentin et al. 2005).

Warkentin et al. (2005) reported densities of merlins range from 3.8 to 25.4 merlins per 100 square kilometers. According to trend data available from the BBS, the number of merlins observed during the breeding season are showing an increasing trend in Maine estimated at 5.9% annually since the BBS was initiated in 1966 (Sauer et al. 2011). Merlins observed on BBS routes in the eastern United States are showing an increasing trend estimated at 2.5% and an increasing trend for the entire United States estimated at 2.2% annually (Sauer et al. 2011). Information from the MDIFW indicates that merlins are considered a species that has expanded its range in Maine in recent years and is likely exhibiting an increasing trend (C. Todd, MDIFW pers. comm. 2010).

Merlins have been identified as potential predators to both young and adult T&E waterbirds, and have been documented as a predator of piping plover adults and chicks. For example, in Michigan, predation by merlins has increased in recent years. From 2005 to 2009, 18 adult piping plovers were predated by merlins (USFWS 2009). To date, the WS program in Maine has not assisted with threats associated with merlins; however, some entities, such as airports, do occasionally address this species when they threaten aviation safety. According to the USFWS, no merlins were lethally taken by any entities in the State of Maine between 2007 and 2011, although the take of 10 merlins was authorized within the State during that period.

To alleviate threats of predation on T&E species associated with merlins, WS anticipates that up to five merlins could be live-captured using bal-chatri traps, pole traps, or Swedish Goshawk traps and translocated from areas where nesting occurs by plovers and terns. All merlins live-captured in traps would be translocated to an area not less than 50 miles away and released into appropriate habitat. In addition, merlins captured and translocated could be banded for identification purposes using United States Geological Survey approved metal leg-bands appropriate for the species. Banding would occur pursuant to a banding permit issued by the United States Geological Survey. Fair et al. (2010) stated "[w]*hen appropriate* [leg] *band sizes are used, the occurrence and rate of adverse effects on the subjects is ordinarily very low*". As a condition of WS' depredation permit issued by the USFWS, any translocation of raptors would be coordinated and/or approved with the MDIFW. If translocation sites could not be located, merlins live-captured could be relinquished to licensed bird rehabilitators to hold in captivity until after young T&E waterbirds have fledged and left the nesting area. The licensed bird rehabilitators would be responsible for the care and release of the merlins back into the wild after the nesting season.

The best available information estimated the statewide breeding population of merlins at 700 birds (Rich et al. 2004). Although the live-capture and translocating of merlins would be a non-lethal method of reducing predation risks, merlins could be translocated during their nesting season, which could lower nesting success. Breeding of merlins occurs as early as March with eggs observed most commonly in April through July, and nestlings are usually present through August (Warkentin et al. 2005).

The incubation of eggs is conducted by both the male and female; however, the female conducts the vast majority (>85%) of incubating (Warkentin et al. 2005). Male merlin supply food to the incubating female and the hatchlings (Warkentin et al. 2005). Information on the nesting success of merlins after the removal of one of the adults is not available.

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

The average clutch size for breeding pairs of merlins is four eggs, and the average number of chicks produced during the breeding season is between three and four (Warkentin et al. 2005). If the live-capture and translocation of five merlins resulted in five failed nests, the total number of fledglings produced in the State would be reduced by 20 merlins if no other factors were considered.

The maximum number of merlins that could be prevented from fledging by translocating adults to alleviate nest predation would represent 2.9% of a statewide breeding population estimated at 700 merlins. However, since nesting success rates vary under normal conditions, the translocation of adult merlins and any subsequent nest failures that result from the translocation would likely represent a lower percentage of the estimated breeding population.

The take of merlins, including live-capture and translocation, can only occur when permitted by the USFWS pursuant to the MBTA through the issuance of depredation permits. Therefore, all take, including take by WS, would be authorized by the USFWS and would occur at the discretion of the USFWS. The take of merlins would only occur at levels authorized by the USFWS, which ensures cumulative take would be considered as part of population management objectives for merlins in the State.

Great-horned Owl Population Impact Analysis

The great-horned owl is a large, powerful owl that is well adapted to live in varying climates and to capture a diversity of prey. Great-horned owls live in grasslands, deserts, forests, and even suburban areas. They range from the tree line in northern Canada and Alaska, southward throughout the entire contiguous United States, into Central America and parts of South America (Houston et al. 1998).

Great-horned owls are the largest (length 46 to 63 cm) and heaviest (0.91 to 2.5 kg) North American owl. They are distinct in appearance with several distinguishing features that include large ear tufts, a white bib, and prominent yellow eyes. Males and females are similar in appearance and include brown, buff, and black-lines (Houston et al. 1998).

In the eastern United States, great-horned owls inhabit dense forests that provide ample cover and high prey densities, and in contrast, these owls are also found where habitats are fragmented but where prey species are present (Bent 1961). A wide variety of habitats are utilized and include deciduous, mixed, and conifer forests, as well as swamps, young forests, and agricultural fields (Houston et al. 1998).

Great-horned owls are the earliest breeding owl; they commonly lay eggs in February which require constant brooding during cold periods, and hatch after 28 days (Bent 1961). Clutch size is commonly two eggs that are incubated by the female only while the male delivers food throughout brood rearing. Young great-horned owls develop slowly. At six weeks, the young will move to nearby branches, and once fledged (45 to 49 days) will only move short distances (Houston et al. 1998).

Great-horned owls typically breed by two years of age; although, some owls fail to establish territories. They are one of the longest-lived owls, living up to 20 years. Great-horned owls are primarily limited by prey abundance (especially young owls) and synchrony with cyclic prey populations has been documented (Houston et al. 1998). Home range estimates vary widely (70 to 883 ha) for great-horned owls and may be influenced by prey availability and owl density. Although few population estimates are available, density commonly varies from 0.10 to 0.20 pair per km^2 in selected prime habitat where most such studies are done (Houston et al. 1998). Rich et al. (2004) estimated the breeding population of great horned owls in Maine at 1,500 owls. Trend data from the BBS indicates the number of owls observed along routes surveyed in Maine has shown a decreasing trend estimated at -1.0% annually since 1966 (Sauer et al. 2011). The number of owls observed overwintering in the State has shown a cyclical pattern but general stable trend since 1966 (National Audubon Society 2010). Local information from the MDIFW confirms their widespread distribution in Maine, and stable population trends (C. Todd, MDIFW pers. comm. 2010). Finally, information from the Breeding Bird Atlas Explorer project indicates that great-horned owls have been confirmed at locations in 43 of 626 total blocks (156 blocks contained evidence), but a distribution map is unavailable (Breeding Bird Atlas Explorer 2010).

Great-horned owls have been documented as a predator to both young and adult T&E waterbirds in Maine. In previous years, great-horned owls have been trapped and translocated from seabird nesting islands (S. Hall, National Audubon Society, pers. comm. 2010), and have also been theorized as causing the loss of 14 piping plover chicks in ten days during the 2010 nesting season (WS, unpublished data). To date, the WS program in Maine has not captured any great-horned owls in Maine, although other entities sometimes take this species to protect livestock, natural resources, or human safety. The USFWS authorized the lethal take of 19 great-horned owls in the State from 2007 through 2011. Between 2007 and 2011, three great-horned owls were lethally taken by all entities in the State of Maine.

To alleviate threats of predation on T&E species associated with great-horned owls, WS anticipates that up to five great-horned owls could be live-captured using bal-chatri traps, pole traps, or Swedish Goshawk traps and translocated from areas where nesting occurs by plovers and terns. All great-horned owls live-captured in traps would be translocated to an area not less than 50 miles away and released into

appropriate habitat. In addition, great-horned owls captured and translocated could be banded for identification purposes using United States Geological Survey approved metal leg-bands appropriate for the species. Banding would occur pursuant to a banding permit issued by the United States Geological Survey. Fair et al. (2010) stated "[w]*hen appropriate* [leg] *band sizes are used, the occurrence and rate of adverse effects on the subjects is ordinarily very low*". As a condition of WS' depredation permit issued by the USFWS, any translocation of raptors would be coordinated and/or approved with the MDIFW. If translocation sites could not be located, great-horned owls live-captured could be relinquished to licensed bird rehabilitators to hold in captivity until after young T&E waterbirds have fledged and left the nesting area. The licensed bird rehabilitators would be responsible for the care and release of the great-horned owls back into the wild after the nesting season.

The best available information estimated the statewide breeding population of great-horned owls at 1,500 birds (Rich et al. 2004). Although the live-capture and translocating of great-horned owls would be a non-lethal method of reducing predation risks, great-horned owls could be translocated during their nesting season which could lower nesting success. Breeding of great-horned owls occurs as early as February with eggs present in March. The incubation of eggs is conducted by females only, but males deliver food throughout an approximate 33-day incubation period (Houston et al. 1998). The young owls leave the nest at six weeks, and then are capable of flying short distances by seven weeks, but overall, are slow developers (Houston et al. 1998). Information on the nesting success of great-horned owls after the removal of one of the adults is not available.

Clutch size for breeding pairs of great-horned owls ranges from one to five eggs, with the average clutch size of two (Houston et al. 1998). If the live-capture and translocation of five great-horned owls resulted in five failed nests, the total number of fledglings produced in the State would be reduced by approximately 10 great-horned owls, if no other factors were considered. If the 10 owls were prevented from entering the breeding population, the removal would represent 0.7% of the estimated statewide breeding population.

The take of great-horned owls, including live-capture and translocation, can only occur when permitted by the USFWS pursuant to the MBTA through the issuance of depredation permits. Therefore, all take, including take by WS, would be authorized by the USFWS and would occur at the discretion of the USFWS. The take of great-horned owls would only occur at levels authorized by the USFWS, which ensures cumulative take would be considered as part of population management objectives for great-horned owls in the State.

Gull Population Analysis and the Potential Biological Removal Model

As was discussed in Section 1.4 of this EA, WS has prepared an EA that analyzes the need for action associated with damage caused by herring gulls, ring-billed gulls, great black-backed gulls, and laughing gulls, including the threats those species of gulls pose to T&E species (USDA 2010). Based on the analyses in that EA, a Decision and FONSI were signed selecting the proposed action alternative, which implemented an adaptive approach to managing damage associated with gulls using multiple methods that would be integrated together to meet the need for action (USDA 2010). Activities conducted by WS and the cooperating agencies relating to alleviating predation and competition threats associated with gulls and T&E species would be conducted in accordance with the selected alternative addressed in that EA, including those methods that would be available under the proposed action alternative (USDA 2010). Gulls and activities relating to alleviating predation and competition associated with gulls are discussed in this EA to provide a better understanding of the scope of activities that could be conducted under the proposed action alternative evaluated in this EA.

Information from the gull damage management EA (USDA 2010) has been summarized and referenced

here to provide context and to further the understanding of the scope of activities being proposed when addressing threats to T&E species under the proposed action alternative evaluated in this EA.

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

The USFWS recently completed PBR models for ring-billed gulls, herring gulls, great black-backed gulls, and laughing gulls that nest in BCR 14 and BCR 30. The gulls present in Maine are those gulls likely to migrate from, or have breeding colonies in, BCR 14 and BCR 30, which covers most of the coastal and inland areas of the upper northeastern United States. Since population estimates and trends for gulls are often limited, the PBR models developed by the USFWS for BCR 14 and BCR 30 were used to analyze potential population impacts of the proposed activities (USDA 2010).

Allowable harvest models for bird species have had a long history of use in the United States, primarily with waterfowl species to determine allowable harvest during annual hunting seasons. Although no hunting season exists for gulls, the take of gulls under depredation permits issued by the USFWS can occur. To use the PBR method to determine levels of allowable take, or cumulative impacts over a large geographic area, the information required includes a minimum estimate of the population size using science-based monitoring programs (*e.g.*, BBS, CBC, coordinated colony surveys), and the intrinsic rate of population growth. The formula for the PBR model is:

$$\text{PBR} = ½\, R_{\max} N_{\min} \text{F}_\text{R}$$

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

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

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

where p is adult annual survival rate, $l\alpha$ is the survival rate from birth to age at first reproduction, b is the number of female offspring per female of reproductive age per year, α is the age at first reproduction, ω is the age at last reproduction, and λ is the intrinsic rate of population change. After solving the above equation for λ, $R_{\max}$ was estimated as $\ln(\lambda)$. Population parameter estimates were taken from the literature for each gull species (see Table 4-4), or in cases where estimates were not available, surrogate estimates from closely related species were used (Seamans et al. 2007).

Table 4-4. Demographic parameter estimates (θ) used for estimating $R_{\max}$ and Potential Biological Removal of gulls in BCR 14 and BCR 30 (Seamans et al. 2007).

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

[1]Good 1998
[2]Pierotti and Good 1994
[3]Burger 1996, Dinsmore and Schreiber 1974
[4]Ryder 1993, Seamans et al. 2007

Because there was uncertainty associated with demographic parameter estimates, allowable take levels were calculated using a simulation approach to estimate a range of R_{max} values with parameter estimates randomly drawn from normal distributions based on reported standard errors (See Table 4-4; Seamans et al. 2007). Population estimates (N_{min}) for each species were based on the number of gulls at known breeding colonies in BCR 14 and BCR 30 during the mid-1990s (MANEM Waterbird Regional Plan 2006), and adjusted using a conservative estimate of 0.75 non-breeding gulls per breeder to estimate the total population (Seamans et al. 2007). Allowable take levels (± 95 CI) for each of the gull species under three recovery factors (0.5, 1.0, 1.5) in BCR 14 and BCR 30 are presented in Table 4-5.

Table 4-5. Potential Biological Removal (± 95% CI) of gulls in BCR 14 and BCR 30 under three recovery factors (Seamans et al. 2007).

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

Most states in the northeastern United States periodically conduct colonial waterbird surveys to determine breeding population trends for many colonial waterbirds, including gulls. Most state-level population estimates are provided as the number of breeding pairs of gulls surveyed. Therefore, one breeding pair equals two gulls. Gulls are migratory bird species and the breeding population of gulls estimated at the state-level is only representative of the number of gulls present in a state during a short period (*i.e.*, during the breeding season). The breeding colony surveys do not account for migratory gulls present during the winter, nor do they account for the population of non-breeding gulls (*i.e.*, sub-adults and non-breeding adults) present during the breeding season. Therefore, to better account for the mobility of gulls and the fact that gulls present in the northeastern United States are likely gulls that nest and migrate throughout BCR 14 and BCR 30, the USFWS developed models based on the geographical scope of the nesting populations of gulls. In addition, PBR models developed by the USFWS are based on breeding and non-breeding gulls, as opposed to colonial waterbird surveys. PBR models estimate allowable take by calculating a total population for each gull species using 0.75 non-breeding gulls for every breeding adult. Since the take of gulls to alleviate damage can occur throughout the year and not just during the breeding season, a comprehensive model like the PBR model, that includes non-breeding populations of gulls,

allows for a systemic analysis of allowable take on gull populations.

Ring-billed Gull Population Effects

Ring-billed gulls are migratory birds that prefer to nest on islands with sparse vegetation. The breeding population of ring-billed gulls is divided into two sub-populations; the western population and the eastern population. The eastern breeding population of the United States includes New York, Vermont, Ohio, Illinois, Michigan, Wisconsin, and Minnesota (Blokpoel and Tessier 1986). Ring-billed gulls nest in high densities and may be located on islands, parklands, slag yards, rooftops, breakwalls, and landfills (Blokpoel and Tessier 1986). The number of ring-billed gulls observed in Maine increased rapidly from the 1970s through 1990s, likely due to the expansion of populations that were experiencing similar increases in the Great Lakes regions (Greenlaw and Sheehan 2003). Ring-billed gulls are now known to breed in Maine in at least two locations, and are a common inhabitant throughout Maine during most of the year (Greenlaw and Sheehan 2003).

The Mid-Atlantic, New England, Maritimes (MANEM) Regional Waterbird Plan (2006) reported regional populations of ring-billed gulls have increased at a rate of 8% to 11% per year since 1976, with a regional breeding population of 40,844 gulls in 13 colonies reported in the 1990s. Similar rates of increase were observed for populations of ring-billed gulls in Maine (Greenlaw and Sheehan 2003). The overall regional population of ring-billed gulls in BCR 14 and BCR 30 is estimated at 54,000 gulls. No breeding population estimates are currently available for Maine; however, the MDIFW reports that populations of ring-billed gulls are increasing because of expanding breeding populations in the St. Lawrence River and Lake Champlain in Vermont (B. Allen, MDIFW pers. comm. 2007). In 1984, the population of ring-billed gulls in the Great Lakes region was estimated at approximately 648,000 pairs (Blokpoel and Tessier 1986). Blokpoel and Tessier (1992) found that the nesting population of ring-billed gulls in the Canadian portion of the lower Great Lakes system increased from 56,000 pairs to 283,000 pairs from 1976 to 1990.

Ring-billed gulls are considered a species of lowest concern in BCR 14, which encompasses most of the State of Maine (MANEM Regional Waterbird Plan 2006). Almost 41,000 ring-billed gulls are believed to breed in BCR 14. CBC data from 1966 through 2010 shows an increasing population trend for wintering populations of ring-billed gulls throughout the State (National Audubon Society 2010). A similar increase has also been documented on BBS routes in Maine (Sauer et al. 2011). Since 1966, ring-billed gulls have shown an increasing trend in Maine estimated at 10.8% annually, with the population beginning to expand in the mid-1980s (Sauer et al. 2011). In the eastern BBS region, the number of ring-billed gulls observed has also shown an increasing annual trend estimated at 5.9% since 1966 with the trend across all routes in the United States estimated to be increasing at 3.4% annually, which is statistically significant (Sauer et al. 2011).

Ring-billed gulls are a common species along the Maine coast in the summer. Their commonality and opportunistic feeding behavior presents a threat to nesting T&E waterbirds. In addition to nest predation, ring-billed gulls are also responsible for causing damage to agricultural resources, other natural resources, property, and posing threats to human safety. Based on previous requests for assistance received by WS, the cumulative take of ring-billed gulls by WS, including ring-billed gulls that could be taken to alleviate nest predation, would not exceed 400 ring-billed gulls annually during all damage management activities as identified in a previous EA (USDA 2010). To ensure a cumulative analysis of the potential take of ring-billed gulls to alleviate damage and to reduce risks of nest predation, this EA will evaluate the lethal take of up to 400 ring-billed gulls annually; however, take of ring-billed gulls to alleviate nest predation would not exceed 50 ring-billed gulls.

Ring-billed gulls are protected from take under the MBTA. However, take can occur pursuant to the

MBTA through depredation permits issued by the USFWS. WS' take of gulls occurs under permits issued to WS. The number of permits issued by the USFWS to all entities in Maine and the number of adults and nests authorized to be taken are identified in Table 4-6.

Table 4-6. Number of adults/nests authorized by USFWS permit and reported taken for ring-billed gulls by all non-WS entities in Maine, 2007-2011.

Ring-billed Gulls	Adults		Nests	
	Authorized	Taken	Authorized	Taken
2007	915	39	0	0
2008	896	65	5	5
2009	1009	52	0	0
2010	1159	121	0	0
2011	759	59	20	0

From FY 2007 to FY 2011, WS' take of ring-billed gulls has ranged from 196 in FY 2007 to 257 in FY 2008 (see Table 4-3). From FY 2007 to FY 2011, the total lethal take of ring-billed gulls in Maine by all other non-WS entities has ranged from 39 gulls taken in FY 2007 to 121 gulls taken in FY 2010 (see Table 4-6). When combined, the highest cumulative take of 357 ring-billed gulls in Maine occurred in 2010 and represented 0.7% of the regional breeding population. No ring-billed gull nests or eggs were destroyed by WS from FY 2007 through FY 2011, although other entities destroyed five nests during that period.

From 2003 through 2010, the number of ring-billed gulls taken annually in the northeastern United States (USFWS Region 5) has ranged from 403 to 3,325 ring-billed gulls with an average annual take of 1,748 ring-billed gulls. The PBR model developed by the USFWS currently predicts that 3,065 ring-billed gulls could be taken annually to maintain the current population levels in BCR 14 and BCR 30, which encompasses the northeastern United States. Based on the known take of ring-billed gulls occurring annually in BCR 14 and BCR 30, the take level from all known sources has been below the estimated level that would cause a population decline. The USFWS would use the PBR model to determine allowable take for ring-billed gulls when issuing permits; therefore, the number of gulls allowed to be taken pursuant to depredation permits issued by the USFWS would remain within those levels analyzed in the models (USDA 2010).

Based on the best available information described above, WS' potential impacts to populations of ring-billed gulls has been and is expected to continue to be insignificant to the overall viability and reproductive success of ring-billed gull populations on a local, regional, and nationwide scale. This determination is based on the increasing regional trends of ring-billed gull populations as derived from BBS data and PBR data for BCR 14 and BCR 30. WS' take and all known take in the northeastern United States since 2003 has not reached a level that indicates an adverse effect to ring-billed gull populations is occurring. The USFWS, as the agency with migratory bird management responsibility, could impose restrictions on depredation harvest as needed to assure cumulative take does not adversely affect the continued viability of populations. This should assure that cumulative impacts on ring-billed gull populations would have no significant adverse effect on the quality of the human environment (USDA 2010).

Herring Gull Population Effects

Herring gulls are the most widely distributed gulls in the Northern Hemisphere. Herring gulls breed in colonies near oceans, lakes, or rivers (Bent 1921). In the northeastern United States, herring gulls nest along the Great Lakes and along the Atlantic Coast from Maine to northern South Carolina. Herring gulls

will nest on natural or man-made sites, such as rooftops and breakwalls (Blokpoel and Scharf 1991).

Almost 91,000 herring gulls are believed to breed in BCR 30. In addition, over 196,000 herring gulls are believed to breed in BCR 14 (MANEM Regional Waterbird Plan 2006). Herring gulls have decreased approximately 38% in the same area between 1970 and the 1990s (MANEM Regional Waterbird Plan 2006), although the statewide population of breeding herring gulls has increased slightly over the past 15 years in Maine. In 1990, the statewide population of herring gulls was estimated at 27,000 breeding pairs (Pierotti and Good 1994). The MDIFW conducted a gull census in 2008 which estimated the number of breeding pairs at approximately 24,855 at 180 colonies in Maine (B. Allen, MDIFW, pers. comm. 2012); although, the survey does not account for gulls that nest on rooftops or at other anthropomorphic locations.

According to trend data available from the BBS, the number of herring gulls observed during the breeding season were showing a decreasing trend in Maine estimated at -4.3% annually since the BBS was initiated in 1966, which is a statistically significant trend (Sauer et al. 2011). Herring gulls observed on BBS routes in the eastern United States are showing a decline estimated at -3.2% between 1966 and 2010, with a smaller decline occurring since 2000 estimated at -2.4% annually (Sauer et al. 2011). In BCR 14, the number of herring gulls observed along routes surveyed during the BBS has shown a declining trend since 1966 estimate at -5.0% annually, which is statistically significant (Sauer et al. 2011). In BCR 30, herring gulls are also showing a declining trend based on BBS data estimated at -5.1% annually since 1966, which is also a statistically significant trend (Sauer et al. 2011). In the United States as a whole, herring gulls are showing a decline estimated at -3.6% annually since 1966, which is also statistically significant (Sauer et al. 2011).

CBC trend data also indicates a decline in the number of herring gulls observed wintering in Maine since 1966 (National Audubon Society 2010). In areas of the State surveyed during the CBC, observers have counted an average of 21,860 herring gulls per year between 2001 and 2010. The lowest number counted during the CBC conducted from 2001 through 2010 occurred in 2007 when 18,795 herring gulls were observed. The highest number of herring gulls counted in areas surveyed from 2001 through 2010 occurred in 2008 when 23,821 gulls were counted (National Audubon Society 2010). During the 2010 count year, 21,581 herring gulls were observed overwintering in Maine (National Audubon Society 2010).

Under the MANEM Waterbird Conservation Plan (2006), herring gulls are considered a species of low concern in North America and of moderate concern in BCR 14, which includes most of Maine. In BCR 30, which includes the extreme southwest corner of the State, the herring gull is considered a species of low concern also (MANEM Regional Waterbird Plan 2006). As previously discussed, the USFWS has developed a PBR model to estimate the allowable take of herring gulls in BCR 14 and BCR 30, which includes Maine. Based on the model, an allowable harvest of up to 16,725 herring gulls in BCR 14 and BCR 30 would maintain current population levels in those two regions. The take of herring gulls also occurs by other entities (*e.g.*, airports, landfills) through depredation permits issued by the USFWS. In the northeastern United States (USFWS Region 5), the average annual reported take of herring gulls from 2003 through 2010 has been 2,814 herring gulls by all entities issued depredation permits by the USFWS. Herring gull take by all entities has ranged from 1,772 gulls to a high of 3,994 gulls taken under depredation permits issued by the USFWS between 2003 and 2010.

Herring gulls are a common species along the Maine coast in the summer. Their commonality and opportunistic feeding behavior presents a threat to nesting T&E waterbirds. In addition to nest predation, herring gulls are also responsible for causing damage to agricultural resources, other natural resources, property, and posing threats to human safety. Based on previous requests for assistance received by WS, the cumulative take of herring gulls by WS, including herring gulls that could be taken to alleviate nest

predation, would not exceed 300 herring gulls annually during all damage management activities as identified in a previous EA (USDA 2010). To ensure a cumulative analysis of the potential take of herring gulls to alleviate damage and to reduce risks of nest predation, this EA will evaluate the lethal take of up to 300 herring gulls annually; however, take of herring gulls to alleviate nest predation would not exceed 50 herring gulls.

Herring gulls are protected from take under the MBTA. However, take can occur pursuant to the MBTA through depredation permits issued by the USFWS. WS' take of gulls occurs under permits issued to WS. The number of permits issued by the USFWS to all entities in Maine and the number of adults and nests authorized to be taken are identified in Table 4-7.

From FY 2007 to FY 2011, WS' take of herring gulls has ranged from 47 in FY 2008 to 161 in FY 2011 (see Table 4-3). From FY 2007 to FY 2011, the total lethal take of herring gulls in Maine by all other non-WS entities has ranged from 133 gulls taken in 2011 to 225 gulls taken in 2010 (see Table 4-7), which represents 0.05% and 0.08% of the regional breeding population, respectively. The number of nests taken statewide between 2007 and 2011 has varied from 338 to 951.

As mentioned previously, the take of herring gulls can also occur by other entities (*e.g.*, airports, landfills) through depredation permits issued by the USFWS. The amount of gull take that has been authorized by the USFWS between 2007 and 2011 has ranged between 1,070 and 1,748 adult gulls, and 970 and 3,650 nests (see Table 4-7).

Table 4-7. Number of adults/nests authorized by USFWS permit and reported taken for herring gulls by all non-WS entities in Maine, 2007-2011.

Herring Gulls	Adults		Nests	
	Authorized	**Taken**	**Authorized**	**Taken**
2007	1,555	154	370	936
2008	1,070	178	970	338
2009	1,748	212	3650	473
2010	1,543	225	1425	951
2011	1,184	133	1320	498

Impacts due to nest/egg removal and destruction should have no adverse effect on the herring gull population regionally and in Maine (USDA 2010). Nest and egg destruction methods are considered non-lethal when conducted before the development of an embryo. Additionally, herring gulls are a long-lived species and have the ability to identify areas with regular human disturbance and low reproductive success, which causes them to relocate and nest elsewhere when confronted with repeated nest failures. Although there may be reduced fecundity for the individuals affected, this activity has no long-term effect on breeding adult herring gulls. Nest and egg removal would not be used by WS as a population management method. This method would be used by WS to inhibit nesting in an area experiencing damage due to nesting activity and would be intended to disperse a nesting pair or colony of herring gulls to an area where there are no conflicts.

To maintain current population levels, the PBR model developed by the USFWS predicts that 16,725 herring gulls could be taken in BCR 14 and BCR 30 annually (see Table 4-5). WS' proposed take of up to 300 herring gulls annually and up to 50 nests along with take by other entities is expected to continue to be insignificant to the overall viability and reproductive success of herring gull populations on a local, regional, and nationwide scale (USDA 2010). Known take of herring gulls is below the level that the PBR model predicts would cause a decline in the population in the northeastern United States from take permitted by the USFWS. WS' take of herring gulls along with take by other entities in Maine would

continue to have no adverse effect on herring gull populations in the State (USDA 2010). The permitting of take by the USFWS provides outside evaluation to ensure WS' take occurs within the allowed limits to maintain viability and growing populations.

The USFWS, as the agency with migratory bird management responsibility, could impose restrictions on depredation harvest as needed to assure cumulative take does not adversely affect the continued viability of populations. This should assure that cumulative impacts on herring gull populations would have no significant adverse effect on the quality of the human environment (USDA 2010).

Great Black-backed Gull Population Effects

The great black-backed gull is essentially a marine species, which breeds in the North Atlantic region. In the United States, the great black-backed gull breeds south to Long Island, New York (Bull 1974). During the winter, great black-backed gulls can also be found along the Great Lakes and larger rivers, such as the St. Lawrence River (Bull 1974, Angehrn et al. 1979). In Maine, great black-backed gulls nest along the coastal areas of the State. The over-wintering population of great black-backed gulls has been increasing along the Great Lakes, along with the expansion of their breeding range (Angehrn et al. 1979). During the winter, great black-backed gulls can also be found at inland feeding areas such as landfills and restaurants.

The population of great black-backed gulls in the southern New England and Mid-Atlantic Region has been estimated at 28,000 breeding pairs (MANEM Regional Waterbird Plan 2006). Great black-backed gulls have increased about 39% across the entire 13 northeast state region from the 1970s through the 1990s (MANEM Regional Waterbird Plan 2006). Canadian Wildlife Service reports that the population figures for the great black-backed gull populations in the Northeast (*i.e.*, along the St. Lawrence River) have increased in the last twenty years (Canadian Wildlife Service 2002). The Maine population of breeding great black-backed gulls underwent a period of increase in the 1990s, and 2000s, but most recently, some decline has been observed, most likely due to eagle predation (B. Allen, MDIFW, pers. comm. 2012). In 1984, the statewide population of great black-backed gulls was estimated at 11,500 breeding pairs (Good 1998). In 2008, the MDIFW estimated the number of breeding pairs at approximately 9,536 on 180 coastal islands for the State of Maine (B. Allen, MDIFW, pers. comm. 2012).

CBC data gathered in Maine from 1966 through 2010 shows a stable to declining population trend for wintering populations of great black-backed gull throughout the State (National Audubon Society 2010). BBS data indicates a declining population trend for great black-backed gulls in Maine estimated at -8.1% annually since 1966, which is statistically significant (Sauer et al. 2011). Across all routes in the United States, BBS data indicates populations are declining at an estimated rate of -0.2% annually since 1966; however, from 2000 through 2010, the number observed has increased 8.3% annually in the United States (Sauer et al. 2011). BBS data compiled for BCR 30 shows an increasing trend in the number of nesting great black-backed gulls estimated at 2.5% annually since 1966, with an 11.2% annual increase from 2000 through 2010 (Sauer et al. 2011). In BCR 14, the number of great black-backed gulls observed has shown a declining trend estimated at -2.2% annually from 1966 through 2010, with a -0.1% decline occurring from 2000 through 2010 (Sauer et al. 2011).

According to the MANEM Regional Waterbird Plan (2006), great black-backed gulls are considered a species of lowest concern in BCR 30 and of low concern in BCR 14. Over 37,000 great black-backed gulls are believed to breed in BCR 30 with over 115,000 great black-backed gulls nesting in BCR 14. Of these, over 43,500 occur in the Gulf of Maine, which includes Maine. To maintain the current population levels in BCR 14 and BCR 30, the PBR model developed by the USFWS predicts take of 11,234 great black-backed gulls would not cause a decline in gull populations in BCR 14 or BCR 30 (see Table 4-5).

Great black-backed gulls are a common species along the Maine coast in the summer. Their local abundance and predatory feeding behavior presents a threat to nesting T&E waterbirds. In addition to nest predation, great black-backed gulls are also responsible for causing damage to agricultural resources, other natural resources, property, and posing threats to human safety. Based on previous requests for assistance received by WS, the cumulative take of great black-backed gulls by WS, including great black-backed gulls that could be taken to alleviate nest predation, would not exceed 125 great black-backed gulls and 75 eggs annually. A previous EA that was prepared by WS and the USFWS (USDA 2010) identified the statewide take of great black-backed gulls to be no greater than 25 gulls and 25 eggs annually. To ensure a cumulative analysis of the potential take of great black-backed gulls to alleviate damage and to reduce risks of nest predation, this EA will evaluate the lethal take of up to 125 great black-backed gulls and take of 75 eggs annually; however, take of great black-backed gulls to alleviate nest predation would not exceed 100 great black-backed gulls and 50 eggs annually.

Similar to the other gull species discussed, the USFWS has issued depredation permits allowing take of black-backed gulls to entities other than WS for damage management purposes. Table 4-8 shows the authorized take of great black-backed gulls permitted by the USFWS and the reported take for all other non-WS entities receiving depredation permits. The number of great black-backed gulls taken in Maine by all other non-WS entities has ranged from 32 to 115 gulls (see Table 4-8), with an average of 64 great black-backed gulls taken annually by all other non-WS entities.

From 2003 through 2010, the number of great black-backed gulls taken in the northeastern United States (USFWS Region 5) has ranged from 360 to 952 gulls with an average of 582 great black-backed gulls taken annually by all entities. The average annual take of great black-backed gulls in the USFWS Region 5 by all entities authorized to take gulls through depredation permits has been below the level of annual take required to maintain current population levels. The average annual take of great black-backed gulls by all entities authorized to take gulls through depredation permits is below the level of annual take required to maintain current population levels. To cause a population decline, the PBR model estimates that nearly 17,000 great black-backed gulls would have to be taken annually in the region. According to the PBR model, the average annual take by all entities in Maine is below the allowable level that would cause a decline in the population of great black-backed gulls (USDA 2010).

Table 4-8. Number of adults/nests authorized by USFWS permit and reported taken for great black-backed gulls by non-WS entities in Maine, 2007-2011.

Great Black-Backed Gulls	Adults		Nests	
	Authorized	Taken	Authorized	Taken
2007	1255	50	250	447
2008	1361	64	1050	388
2009	1873	61	250	338
2010	1333	115	1310	502
2011	1391	32	1270	407

From FY 2007 to FY 2011, WS' lethal take of great black-backed gulls has ranged from eight gulls taken in FY 2011 to 37 gulls taken in FY 2010, which represents 0.005% and 0.02% of the regional breeding population, respectively. No great black-backed gull nests or eggs were destroyed by WS from FY 2007 through FY 2011. With a current population estimated at 9,536 breeding individual gulls in Maine, WS' lethal take of 125 gulls and 75 eggs would represent 2.1% of the Maine breeding population estimate. Since current surveys for colonial nesting gulls do not account for non-breeding gulls, the number of gulls present in the State during the breeding season is likely higher; therefore, the take of great black-backed gulls is likely a smaller percentage of the actual population present in the State during the breeding season

Based on the best available information described above, WS' potential impacts to populations of great black-backed gulls has been and is expected to continue to be insignificant to the overall viability and reproductive success of great black-backed gull populations on a local, regional, and nationwide scale (USDA 2010). This determination is based on the most recent population estimates for great black-backed gull populations as derived from BBS data and PBR data for BCR 14 and BCR 30. The PBR model predicts great black-backed gulls in BCR 14 and BCR 30 could sustain a harvest of 11,234 individuals and maintain current population levels. WS' take and all known take in the northeastern United States since 2007 has not reached a level that indicates an adverse effect to great black-backed gull populations is occurring or would occur (USDA 2010). With management authority over migratory birds, the USFWS could impose stricter take limits if warranted based on population data. The USFWS, as the agency with migratory bird management responsibility, could impose restrictions on depredation harvest as needed to assure cumulative take does not adversely affect the continued viability of populations. This should assure that cumulative impacts great black-backed gull populations would have no significant adverse impact on the quality of the human environment.

Laughing Gull Population Effects

The laughing gull uses coastal habitats, such as salt marsh islands, sandy islands with scattered patches of long grass (breeding), seacoasts, bays, and estuaries (non-breeding). Non-breeding summer birds can be found 30 to 60 km inland from coastal breeding sites. Breeders may fly 40 km for food. Inland habitat includes meadows, plowed fields, lakes, marshes, impoundments, and pools (MANEM Regional Waterbird Plan 2006).

Laughing gulls can be found nesting along the coastal areas of BCR 14 and BCR 30 with most breeding colonies occurring in BCR 14 (MANEM Regional Waterbird Plan 2006). Over 200,000 laughing gulls nest along the coastal areas in BCR 30 and have been given a conservation rank of lowest concern (MANEM Regional Waterbird Plan 2006). In BCR 14, nesting laughing gulls are estimated at 2,704 gulls and have been given a conservation rank of lowest concern (MANEM Regional Waterbird Plan 2006). The breeding population of laughing gulls in the 1970s was estimated at 129,768 laughing gulls in 63 colonies. In the 1990s, the breeding population had increased to 205,348 laughing gulls in 275 colonies, which represented a 58% increase in regional abundance (MANEM Regional Waterbird Plan 2006). BBS trend data for laughing gulls in the Eastern BBS Region has shown a statistically significant increasing trend estimated at 4.7% annually since 1966 (Sauer et al. 2011). In BCR 30, BBS trend data shows an increasing trend estimated at 5.7% annually since 1966 (Sauer et al. 2011). No BBS data is currently available for Maine (Sauer et al. 2011). CBC data for laughing gulls observed overwintering in the State have shown a relatively stable trend since 1966 (National Audubon Society 2010).

During 2011, the MDIFW estimated the number of breeding pairs at approximately 3,565 on four islands in the State of Maine (B. Allen, MDIFW, pers. comm. 2012). The breeding population of laughing gulls has been variable over the past 10 seasons with a high of 4,477 pairs in 2008 (MDIFW, unpublished data). The associated declines in nesting laughing gulls is attributable to the management of this species, which has incorporated the annual killing of 200 to 400 pairs of laughing gulls for the past four seasons as part of the Laughing Gull Management Plan being conducted by the USFWS (USFWS 2008). The Plan was initiated in response to the range expansion of laughing gulls that began to out-compete roseate terns. The Plan identifies an attempt to reduce the number of laughing gulls at the four managed tern colonies in Maine to 1,450 pairs. This EA would allow WS to assist the USFWS in their effort to achieve the objectives specified in the Plan.

From 2007 through 2011, the lethal annual take of laughing gulls by all entities in Maine has ranged from 34 to 748 gulls with an average annual take of 344 laughing gulls (see Table 4-9). From 2003 through 2010, the lethal annual take of laughing gulls by all entities in the northeastern United States (USFWS

Region 5) has ranged from 4,417 to 5,880 gulls with an average annual take of 5,238 laughing gulls. The PBR model for laughing gulls in BCR 14 and BCR 30 estimates that nearly 15,000 laughing gulls could be taken annually with no adverse effect on the current population. Current take levels from all known entities in the breeding range of laughing gulls has not exceeded the level of annual take that would cause a decline in the breeding laughing gull population based on the PBR model (USDA 2010). Based on the increasing populations observed from summer and winter surveys and the cumulative take of laughing gulls in the northeastern United States being below the level where a decline would occur in the population, WS' take of laughing gulls since FY 2007, with the oversight of cumulative take by the USFWS, has not adversely affected laughing gull populations.

Table 4-9. Number of adults/nests authorized by USFWS permit and reported taken for laughing gulls in Maine by all non-WS entities, 2007-2011.

Laughing Gulls	Adults		Nests	
	Authorized	Taken	Authorized	Taken
2007	150	41	150	1,900
2008	885	630	875	4,318
2009	1,255	748	4050	4,439
2010	1,220	34	4050	2,973
2011	1220	269	3500	2840

As mentioned, laughing gulls are a common species that nest in competition with roseate terns and other rare seabirds on coastal islands in Maine (USFWS 2008). This competition for nesting space and food resources has caused reproductive declines in terns. In addition to nest predation and/or competition, laughing gulls are also capable of causing damage to agricultural resources, other natural resources, property, and posing threats to human safety. Based on previous requests for assistance received by WS, the cumulative take of laughing gulls by WS, including laughing gulls that could be taken to alleviate nest predation, would not exceed 700 laughing gulls and 100 eggs annually. A previous EA that was prepared by WS (USDA 2010) identified the statewide take of laughing gulls to be no greater than 50 gulls and 50 eggs annually. To ensure a cumulative analysis of the potential take of laughing gulls to alleviate damage and to reduce risks of nest predation, this EA will evaluate the lethal take of up to 750 laughing gulls and take of 150 eggs annually; however, take of laughing gulls to alleviate nest predation would not exceed 700 laughing gulls and 100 eggs annually.

WS has conducted no operational damage management activities to minimize or prevent damage caused by laughing gulls in Maine. However, WS is preparing this EA in response to the need for protecting rare seabirds from competition and expanding populations of laughing gulls, and expects to assist the USFWS in seabird restoration (USFWS 2008). The level of take identified in this EA is designed to meet the objectives identified in the Laughing Gull Management Plan (USFWS 2008). This level of take is designed to lower the population of laughing gulls in the State of Maine so that nesting habitat for other seabirds can be maintained.

Based on the best available information described above, WS' potential impacts to populations of laughing gulls has been and is expected to continue to be insignificant to the overall viability and reproductive success of laughing gull populations on a regional and nationwide scale; however, local reductions in breeding laughing gulls could be a result if objectives were achieved. It is unlikely that laughing gull populations within BCR 14 and BCR 30 would be adversely affected because the PBR model predicts laughing gulls in BCR 14 and BCR 30 could sustain a harvest of 15,274 individuals and maintain current population levels.

The USFWS, as the agency with migratory bird management responsibility, could impose restrictions on

depredation harvest as needed if cumulative take was expected to cause adverse effects to the continued viability of regional populations. In this specific case, the USFWS is attempting to use its authority to reduce the Maine nesting population of laughing gulls to improve the nesting success of federally endangered roseate terns (USFWS 2008).

Alternative 4 – Managing Nest Predation Using Non-lethal Methods Only

WS would not be involved with the lethal take of nest predators under this alternative. To resolve requests for assistance, WS would employ only non-lethal methods. Therefore, WS' activities would have no effect on statewide populations of nest predators in the State. Although some harassment and dispersal of nest predators would occur under this alternative by WS, those actions would not adversely affect populations since wildlife would only be dispersed to other areas. Similar to the other alternatives, the lethal take of nest predators could continue to occur under permits issued by the MDIFW and/or the USFWS, when required. Nest predators would also continue to be lethally taken during the regulated harvest seasons.

Non-lethal chemical methods would continue to be available under this alternative. The only non-lethal chemical method currently available that could have application to reducing nest predation is mesurol, which can only be used by WS' employees. Mesurol, containing the active ingredient methiocarb, is registered by the EPA for use to condition crows not to feed on the eggs of T&E avian species. Mesurol is currently registered for use in Maine. Mesurol would be 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 would be placed in the area where the protected species were 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 generally recover. Since crows ingesting mesurol only become sick and generally recover, no adverse effects to crow populations would occur from the use of mesurol. However, crows could be dispersed from the area where application occurs if those crows seek a food source in other areas.

In addition, immobilizing drugs would be available for use by WS under this alternative. Immobilizing drugs would be used to properly restrain and alleviate stress during the handling and/or transport of wildlife once live-captured. For example, if a target species was to be translocated, WS could employ immobilizing drugs to alleviate stress to the animal during transport to the release site and to reduce risks to human safety during the handling and transport of the animal. Generally, immobilizing drugs would only be available for mammal species.

Under this alternative, all live-captured nest predators would be translocated to release sites to alleviate nest predation risks. Documentation exists that live-capturing and translocating wildlife away from nesting areas has negative consequences including disease transmission, stress, mortality of translocated animals, impacts on resident animals at or near release sites, and creating additional damage in release areas (Craven et al. 1998). In addition, the policy of the MDIFW restricts the translocation of red fox, raccoons, and striped skunks to less than five miles, so those species captured by WS would not be released beyond five miles of where those individuals were live-captured (MDIFW Administrative Policy J1.6).

As discussed previously, non-lethal methods are generally regarded as having minimal impacts on overall populations of wildlife since those species would be unharmed. The use of non-lethal methods would have no adverse effects on target wildlife populations in the State.

Issue 2 - Effects of Activities on the Populations of Non-target Wildlife

As discussed previously, a concern is often raised about the potential impacts to non-target species from the use of methods to resolve predation risks associated with nest predators. The potential effects on the populations of non-target wildlife species under each of the alternatives are analyzed below.

Alternative 1 – No Involvement by WS in Managing Predation Risks

Under this alternative, WS would not be directly involved with managing nest predation in the State. Therefore, no direct impacts to non-targets would occur by WS under this alternative. Those nest predators addressed in this assessment would continue to be taken during the regulated harvest season and under the depredation order for blackbirds. Risks to non-targets species would continue to occur from those who implement methods to address nest predation on their own or through recommendations by other federal, State, and private entities. Although some risks occur from those persons that implement methods, those risks would likely be low. Risks to populations of non-targets would be similar to those risks under the other alternatives since most of the methods available for use would be available under all the alternatives.

The ability to reduce predation would be variable and would be based upon the skills and abilities of the person implementing methods under this alternative.

Alternative 2 – Managing Nest Predation Risks by WS through Technical Assistance Only

Under a technical assistance alternative, WS would have no direct impact on non-target species. Methods recommended or provided through loaning of equipment could be employed by those persons requesting assistance. Recommendations would be based on WS' Decision Model using information provided by the person requesting assistance or through site visits. Recommendations would include methods or techniques to minimize non-target impacts associated with the methods being recommended or loaned. Methods recommended could include non-lethal and lethal methods as deemed appropriate by WS' Decision Model and as permitted by laws and regulations.

The 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 were not followed or if other methods were employed that were not recommended, the potential impacts on non-target species would likely be higher compared to the proposed action.

The potential impacts of harassment and exclusion methods on non-target species would be similar to those described under the proposed action. Harassment and exclusion methods are easily obtainable and relatively simple to employ. Since identification of targets occurs when employing most harassment techniques and during the use of firearms, the potential impacts to non-target individuals would likely be low under this alternative.

Those persons seeking to reduce the risk of nest predation may implement methods and techniques based on the recommendations of WS, including lethal removal of nest predators, which could cause lethal take of non-targets. Again, the potential for impacts would be based on the knowledge and skill of those persons implementing recommended methods. If those persons do not implement methods or techniques correctly, the potential impacts from providing only technical assistance could be greater than those potential impacts described under the proposed action. The incorrect implementation of methods or techniques recommended by WS could lead to an increase in non-target take when compared to the non-target take that could occur by WS under the proposed action alternative.

If requestors were provided technical assistance but do not implement any of the recommended actions and take no further action, the potential to take non-targets would be lower when compared to the proposed action. If those persons requesting assistance implement recommended methods appropriately and as instructed or demonstrated, the potential impacts to non-targets would be similar to the proposed action. If WS made recommendations on the use of methods but those methods were not implemented as recommended by WS or if those methods recommended by WS were used inappropriately, the potential for lethal take of non-targets would likely increase under a technical assistance only alternative. Therefore, the potential impacts to non-targets, including T&E species, would be variable under a technical assistance only alternative.

If non-lethal methods recommended by WS under this alternative were deemed ineffective by those requesting assistance, lethal methods could be employed. The potential impacts on non-targets would be highly variable under this alternative. Nest predation that was not effectively resolved by non-lethal control methods could resort to other means of legal or illegal lethal control. This could result in less experienced persons implementing control methods and could lead to greater take of non-target wildlife than the proposed action. When those persons experiencing damage caused by wildlife reach a level where assistance does not adequately reduce damage or where no assistance is available, people have resorted to using chemical toxicants that are illegal for use on the intended target species. The illegal use of methods often results in loss of both target and non-target wildlife (White et al. 1989, USFWS 2001*b*, FDA 2003). The use of illegal toxicants by those persons frustrated with the lack of assistance or assistance that inadequately reduces predation to an acceptable level could result in the indiscriminate take of wildlife species.

The ability to reduce predation risks associated with nest predators would be variable based upon the skills and abilities of the person implementing methods. It would be expected that this alternative would have a greater chance of reducing nest predation risks than Alternative 1 since WS would be available to provide information and advice on appropriately employing methods and reducing the risk of non-target take.

Alternative 3 - Continuing the Current Integrated Approach to Managing Nest Predation (Proposed Action/No Action)

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

Personnel from WS would be experienced with managing wildlife damage and would be trained in the employment of methods, which would allow WS' employees to use the WS Decision Model 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 effects on non-targets are discussed in Chapter 3 of this EA. Despite the best efforts to minimize non-target exposure to methods during program activities, the potential for WS to disperse, live-capture, or lethally take non-targets exists when applying both non-lethal and lethal methods to manage predation risks.

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 were not the primary reason the exclusion was erected; therefore, non-target species excluded from areas may potentially be adversely affected if the area excluded was large enough. The use of auditory and visual dispersal methods to reduce predation risks associated with nest predators would also likely disperse non-targets in the immediate area those methods were employed. Therefore, non-targets may be temporarily dispersed from an area while employing non-lethal dispersal techniques. However, like target species, the potential impacts on non-target species would likely be temporary with target and non-target species often returning after the cessation of dispersal methods.

Non-lethal methods that use auditory and visual stimuli to reduce or prevent predation are intended 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[8]. 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 be similar to those results on both non-target and target species.

Other non-lethal methods available for use under this alternative include cage traps, foothold traps, cable restraints, and repellents. Cage traps, foothold traps, and cable restraints restrain wildlife once captured and are considered live-capture methods. Cage traps, foothold traps, and cable restraints have the potential to capture non-target species. Placement of those methods in areas where target species were active and the use of target-specific attractants would likely minimize the capture of non-targets. If those methods were attended to appropriately, any non-targets captured could be released on site unharmed.

Only those repellents registered with the EPA pursuant to the FIFRA would be recommended and used by WS under this alternative. The only repellent currently registered with the EPA to address nest predation is mesurol for use to discourage crows from feeding on the eggs of T&E species. Mesurol is currently registered for use in Maine and can only be used by WS' personnel. The use of repellents would not have negative effects on non-target species when used according to label requirements. Mesurol would be prepared and inserted into eggs that were similar in appearance and size to the eggs of those species being protected; therefore, only those wildlife species that select for eggs and can ingest the eggs treated with mesurol would potentially be affected by the use of mesurol.

Non-lethal methods would be available under all the alternatives analyzed. 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. Although non-lethal methods do not result in lethal take of non-targets, the use of non-lethal methods can restrict or prevent access of non-targets to beneficial resources. However, 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. Therefore, non-lethal methods would generally be regarded as having minimal impacts on overall populations of wildlife since individuals of those species were unharmed. 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' involvement in the use of or recommendation of non-lethal methods would ensure non-target impacts were considered under WS' Decision Model.

WS could also employ and/or recommend lethal methods under the proposed action alternative to

[8]Non-lethal methods that use auditory or visual stimuli would only be used in ways that would not cause harm to T&E species (*e.g.*, before nesting terns and plovers arrive on nesting grounds, sufficient distance from nesting grounds as determined by the cooperating entities).

alleviate predation risks, when those methods were deemed appropriate for use using the WS Decision Model. Lethal methods available for use to manage predation under this alternative would include shooting, body-gripping traps, snap traps, cable devices, large gas cartridges, the avicide DRC-1339, and the recommendation that nest predators be harvested during a regulated harvest season in the State. In addition, nest predators could also be euthanized once live-captured by other methods. Live-captured nest predators would be euthanized using methods appropriate for the species live-captured in accordance with WS Directive 2.505. Available methods and the application of those methods to resolve predation risks are further discussed in Appendix B.

The use of firearms would essentially be selective for target species since animals would be identified prior to application; therefore, no adverse effects would be anticipated from use of this method. Similarly, the use of euthanasia methods would not result in non-target take since identification would occur prior to euthanizing an animal.

Capture methods, such as body-gripping traps, cable devices, and snap traps, would be set to take target wildlife after being triggered by a target individual. Capture methods would be 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 were as species specific as possible, and modification of individual methods to exclude non-targets from capture. SOPs are intended to ensure take of non-target wildlife would be minimal during the use of methods to capture target wildlife.

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

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

DRC-1339 was selected for reducing nest predation associated with crows and gulls because of its high toxicity to blackbirds (DeCino et al. 1966, West et al. 1967, Schafer, Jr. 1972) and gulls (Blodget and Henze 1992, Eisemann et al. 2003), 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})[9] values for starlings, blackbirds, gulls, 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 (*Zenaidura macroura*), pigeons, quails (*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*b*).

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

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

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

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 the relatively low toxicity of species that might scavenge on birds 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 non-existent.

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). Studies using the American kestrel as a surrogate species show that secondary hazards to

[9] 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.

raptors are small, and these birds are not put at risk by DRC-1339 baiting. 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 and found no non-target carcasses that exhibited histological signs consistent with DRC-1339 poisoning. The other studies also failed to detect any non-target birds that had succumbed to DRC-1339. However, DRC-1339 is a slow-acting avicide and thus, some birds could move to areas not searched by the study participants before dying.

DRC-1339 is unstable in the environment, 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. Aquatic and invertebrate toxicity is low (EPA 1995).

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 their bill, by pushing the food item under the substrate, or covering items with debris (Verbeek and Caffrey 2002). Distances traveled from where the food items were gathered to where the item is cached varies but some studies suggests crows can travel from up to 100 meters (Kilham 1989) to a range of 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 and is considered to have low mobility (EPA 1995). Given the best environmental fate information available and the unlikelihood of a non-target locating enough treated bait(s) sufficient to produce lethal effects, the risks to non-target from crows caching treated bait would be low. When baiting, treated baits are mixed with untreated bait to minimize non-target hazards directly at the bait site and to minimize the likelihood of target species developing bait aversion. Since treated bait is diluted, often times up to one treated bait for every 25 untreated baits, the likelihood of a crow selecting treated bait and then caching the bait is further reduced.

When using gas cartridges, burrows and dens would be observed for the presence of non-targets before

the use of fumigants. If non-target activity (*e.g*., tracks, scat) were observed, the fumigation of those burrows and dens would not occur. Since non-targets have been known to occur in burrows and dens, some risks of unintentional take of non-targets does exist from the use of fumigants. For example, burrows of woodchucks can be used by a variety of non-target species such as the Eastern cottontail, striped skunk, raccoon, red fox, coyote, white-footed mouse (*Peromyscus leucopus*), house mouse (*Mus musculus*), and short-tailed shrew (*Blarina brevicauda*) (Hamilton, Jr. 1934, Grizzell, Jr. 1955, Dolbeer et al. 1991). Dolbeer et al. (1991) found a total of one cottontail rabbit and three mice (*Permyscus* spp.) in three of the 97 woodchuck burrows treated with gas cartridges during the late summer. During 2,064 trap nights at 86 woodchuck burrow entrances targeting small mammals, Swihart and Picone (1995) captured 99 individuals of four small mammal species, which included short-tailed shrews, meadow voles (*Microtus pennsylvanicus*), meadow jumping mouse (*Zapus hudsonius*), and white-footed mice.

Risks to non-targets can be minimized by treating only burrows that appear to be active (Dolbeer et al. 1991). Fumigants would be used in active burrows and dens only, which would minimize risk to non-targets. There are no secondary poisoning risks involved with the use of gas cartridges as the gas produced dissipates into the atmosphere shortly after activation. Primary risks to non-targets would be minimized by treating only active burrows/dens, by covering entrances of burrows/dens, and by following the pesticide label. Although non-targets could be present in burrows/dens, even after WS' conducts site investigations, the risks would be relatively low and unintentional take from the use of fumigants would be limited.

While every precaution would be taken to safeguard against taking non-targets during operational use of methods and techniques for resolving predation risks, the use of such methods could result in the incidental lethal take of unintended species. Those occurrences would be rare and should not affect the overall populations of any species under the current program. The unintentional take and capture of wildlife species during activities to alleviate predation risks conducted under the proposed action alternative would primarily be associated with the use of body-gripping traps, snap traps, cable devices, and in some situations, with live-capture methods, such as foothold traps, cage traps, and cable restraints.

Between FY 2007 and FY 2011, WS has unintentionally killed non-targets during projects to reduce predation risks in Maine. Non-targets unintentionally lethally taken include double-crested cormorants (2), American crows (2), mourning dove (1), blue jay (1), woodchucks (5), porcupines (2), song sparrow (1), gray squirrels (4), red squirrels (7), willet (1), deer mice (4), garter snake (1), and vole (1). Between FY 2007 and FY 2011, the unintentional take of non-targets by WS during activities to alleviate nest predation has been minimal with take not exceeding one or two individuals of any species in any year, with non-target take primarily involving squirrels and woodchucks. The unintentional take of wildlife that has occurred previously during activities to reduce nest predation has been limited and has not reached a magnitude where adverse effects would occur to a species' population.

WS' take of non-target species during activities to reduce predation risks associated with nest predators would be expected to be extremely low to non-existent. WS would monitor the take of non-target species to ensure program activities or methodologies used to manage nest predation do not adversely affect non-targets. Methods available to resolve and prevent nest predation or threats when employed by trained, knowledgeable personnel would be selective for target species. WS would annually report to the USFWS and/or the MDIFW any non-target take to ensure take by WS was considered as part of management objectives established. The potential impacts to non-targets would be similar to the other alternatives and would be considered minimal to non-existent.

As discussed previously, the use of non-lethal methods to address predation or threats of predation would generally be regarded as having no impact on a species' population since those individuals addressed using non-lethal methods would be unharmed and no actual reduction in the number of individuals in a

species' population occurs. Similarly, the live-capture and release of non-targets would generally be regarded as having no adverse effects on a species' population since those individuals would be released unharmed and no actual reduction in the number of individuals in a population occurs. Therefore, the live-capture and subsequent releasing of non-targets during activities conducted under the proposed action alternative would not result in declines in the number of individuals in a species' population.

The lethal take of non-targets could result in declines in the number of individuals in a population; however, the lethal take of non-targets by WS to alleviate nest predation occurs; however, the take has not reach a magnitude where adverse effects would occur. The non-targets taken previously by WS are representative of non-targets that could be lethally taken by WS under the proposed action alternative. Although additional species of non-targets could be lethally taken by WS, take of individuals from any species would not be likely to increase substantively above the number of non-targets taken annually by WS during previous activities. WS would continue to monitor activities, including non-target take to ensure the annual take of non-targets does not result in adverse effects to a species' population.

Alternative 4 – Managing Nest Predation Using Non-lethal Methods Only

A non-lethal management alternative would require WS to only recommend and use non-lethal methods to manage and prevent predation by nest predators. WS would provide technical assistance and direct operational assistance under this alternative recommending and using only non-lethal methods. 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, individual non-target species excluded from areas may potentially be adversely affected if the area excluded was large enough. The use of auditory and visual dispersal methods would also likely disperse non-targets in the immediate area the methods were employed. Therefore, non-targets may be permanently dispersed from an area while employing non-lethal dispersal techniques. However, like target species, the potential impacts on non-target species would be temporary with target and non-target species often returning after the cessation of dispersal methods.

Live traps (*e.g.*, cage traps, walk-in traps, foothold traps) restrain wildlife once captured and are considered live-capture methods. Live traps have the potential to capture non-target species. Trap placement in areas where target species were active and the use of target-specific attractants could minimize the capture of non-targets. If traps were attended to appropriately, any non-targets captured could be released on site unharmed.

Only those repellents registered with the EPA pursuant to the FIFRA would be recommended and used by WS under this alternative. Risks to non-targets from the use of mesurol under this alternative would be similar to those risks to non-targets discussed under the proposed action alternative.

Immobilizing drugs would not be available for use by the public under this alternative and would not be recommended by WS through technical assistance. Immobilizing drugs would only be available for direct operational use by WS' personnel or appropriately licensed veterinarians. Immobilizing drugs would be applied after live-capture occurred through injection or the drugs would be applied through direct application to target individuals from a jabstick. Therefore, immobilizing drugs would only be applied after identification of the target occurred prior to application. No direct affects to non-targets would occur from the use of immobilizing drugs.

WS' involvement in the use of or recommendation of non-lethal methods would ensure non-target impacts were considered under WS' Decision Model. Most non-lethal methods would be available under all the alternatives analyzed. Impacts to non-targets from the use of non-lethal methods would be similar

to the use of those 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 from their use. However, other entities could continue to use lethal methods to alleviate predation under this alternative. Nest predators could still be lethally taken by other entities during the regulated harvest season and as permitted by the USFWS and/or the MDIFW under this alternative using the same methods addressed under the proposed action alternative, except for euthanasia chemicals and DRC-1339. Therefore, non-target take under this alternative by other entities that employ lethal methods could be similar to the take of non-targets that could occur under the proposed action alternative.

Issue 3 – Effects of Activities on Threatened and Endangered Species

To meet the need for action, efforts would occur to protect several bird species considered threatened and endangered from predation by nest predators. Additionally, other T&E species could occur in a project area during the implementation of a selected alternative. The potential effects on the populations of T&E species under each of the alternatives are analyzed below.

Alternative 1 – No Involvement by WS in Managing Predation Risks

Under this alternative, WS would not be involved with any aspect of reducing nest predation of T&E species. Therefore, no direct impacts by WS to T&E species would occur from the implementation of this alternative. Those nest predators addressed in this assessment could continue to be taken during the regulated harvest season, under permits issued by the USFWS and/or the MDIFW, and crows could be lethally taken under the depredation order for blackbirds. Those entities seeking assistance or conducting activities to alleviate nest predation would be responsible for ensuring compliance with the ESA and/or the Maine Endangered Species Act. Risks to T&E species would continue to occur from those persons who implement methods on their own or through recommendations by other federal, State, and private entities. Although some risks would occur from those persons that implement methods to reduce nest predation risks 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 predation risks under the implementation of this alternative would be variable. The variability would be based upon the skills and abilities of the person implementing methods.

Alternative 2 – Managing Nest Predation Risks by WS through Technical Assistance Only

Under a technical assistance alternative, WS would have no direct impact on T&E species. Methods recommended or provided through the loaning of equipment could be employed by those persons requesting assistance. Recommendations would be based on WS' Decision Model using information provided by the person requesting assistance or through site visits. The methods recommended by WS could include non-lethal and lethal methods as deemed appropriate to the situation using the WS' Decision Model and as permitted by laws and regulations. Those persons seeking assistance or conducting activities to alleviate nest predation would be responsible for ensuring compliance with the ESA and/or the Maine Endangered Species Act.

The potential impacts to T&E species under this alternative would be variable and based on several factors. Because state and federal law prohibits the disturbance of T&E species by those persons without a specific permit, the methods recommended by WS would be limited to those without potential impacts, and therefore would be more restrictive than the proposed action. WS' technicians and biologists have been trained in wildlife identification and have been issued state and federal ESA permits that allow access to restricted nesting areas; whereas, other entities performing activities may not have the ability and authorization. Furthermore, if recommended methods and techniques were not followed, or if other methods were employed that were not recommended, the potential impacts on T&E species would likely

be higher compared to the proposed action.

Those persons working to reduce nest predation risks 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 when compared to those potential impacts described in the proposed action if those persons attempting to alleviate predation risks do not implement methods or techniques correctly. Methods or techniques recommended by WS that were implemented incorrectly could lead to an increase in adverse effects on T&E species.

Because the proposed action aims to benefit T&E species, the recommended methods, and how they were applied may either benefit or adversely affect the protected resources. If requestors were provided technical assistance but take no actions, the potential adverse effect to T&E species from the use of methods may be lower compared to the proposed action; however, nest predation may also increase. If those entities requesting assistance implement recommended methods appropriately as instructed or demonstrated and in compliance with the ESA, the potential impacts to T&E species 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 T&E species. Therefore, the potential impacts to T&E species would be variable under a technical assistance only alternative. The ability to reduce predation risks associated with nest predators would be variable based upon the skills and abilities of the person implementing methods. As stated previously, those persons conducting activities would be responsible for ensuring their activities were compliant with the ESA and/or the Maine Endangered Species Act.

Alternative 3 - Continuing the Current Integrated Approach to Managing Nest Predation (Proposed Action/No Action)

WS would employ and/or recommend lethal and non-lethal methods under the proposed action alternative to alleviate predation. Those methods would be employed in accordance with the SOPs discussed in Chapter 3, along with those protocols established by the MDIFW (see Appendix I) and those recommendations made during the consultation processes.

Methods would only be used in areas where T&E species do not occur or would employ methods that would have no effect on T&E species. Through coordination with the USFWS and the MDIFW and having an understanding of the life histories of T&E species that may occur in areas where activities could be conducted, WS can avoid using methods in areas occupied by T&E species or can employ methods when T&E species were not present.

A common concern regarding the use of chemical methods is the potential non-target risks. DRC-1339, Avitrol®, and mesurol are formulated on baits that are not selected for by plovers and terns and would not be employed in areas immediately occupied by plovers and terns. Therefore, those methods would have no effect on plovers and terns. However, the use of those methods could benefit those species by reducing nest predation and increasing productivity.

The ESA prohibits any take of a designated T&E species without a permit and defines what constitutes take. The Maine Endangered Species Act has similar designations. It is possible that the employment of methods to address nest predation may affect the threatened and endangered birds that were nesting where activities were being conducted; however, WS' employees and the cooperating entities would be trained and highly skilled at identifying what methods could cause disturbance. In addition, some essential methods of harassment (*e.g.*, pyrotechnics) would not be utilized due to their potential to disturb nesting T&E species. In past years, both the USFWS and the MDIFW have issued letters of approval to perform

nest predator management in sensitive areas. For these reasons, the adverse effects to piping plovers, least terns, and roseate terns would be low. In addition, activities under the proposed action could prevent nest predation. A reduction in the rate of nest predation could lead to an increase in nesting success for plovers and terns, which could benefit those T&E species.

WS also has reviewed the list of state and federal T&E species in those areas where nesting occurs or could occur, and has identified other species that could be present (see Table 4-10). If those species listed in the State by the USFWS and the National Marine Fisheries Services are not present in the areas where activities could be conducted or are not present during times when those activities could be conducted, then activities conducted under the proposed action would have no effect on those species. Although whales could be present off the coastal waters of Maine, those methods proposed for use would have no effect on the whale species listed in the State based on the use patterns of those methods. The small whorled pogonia could be present in the areas where activities could be conducted; however, based on the use patterns of methods available and coordination with the USFWS, activities conducted would have no effect on the pogonia in areas where it occurs.

The New England cottontail is listed as a candidate species by the USFWS and is considered an endangered species by the MDIFW. The New England cottontail can be found in the extreme southwestern portion of Maine. The cottontail could occupy habitats that are adjacent to waterbird nesting areas at certain locations. WS, in consultation with the MDIFW, have established a protocol for avoiding the capture of cottontail rabbits (see Appendix I). The red knot is also currently classified as a candidate species for listing under the ESA. The red knot is a small shorebird that breeds in the Arctic and winters at the southern tip of South America, and therefore, is a brief visitor to Maine. Consistent with consultations, WS has communicated with the staff of the USFWS regarding the status of these species and the likelihood for predation management to cause take. Staff with the USFWS at the RCNWR has indicated that proper safeguards have been established in the existing protocols that cover predation management (see Appendix I). In general, avoidance of red knots and New England cottontails would be achieved by not placing traps where those species would encounter them. Specifically for New England cottontails, traps would not be set in occupied habitats, or those habitats that could harbor the species (see Appendix I; K. O'Brien, USFWS pers. comm. 2012).

Under this alternative, WS would employ the most selective methods for the target species, would employ the use of baits and lures that were as specific to target species as possible, and determine placement of methods to avoid exposure to T&E species. The methods to avoid adverse effects to piping plovers and least terns were also specified in protocols, which were approved by the MDIFW. WS would follow those procedures outlined in the predation management plan (see Appendix I). SOPs to prevent and reduce any potential adverse effects on T&E species are discussed in Chapter 3 of this EA.

The current list of species designated as threatened and endangered in Maine as determined by the USFWS and the National Marine Fisheries Services was obtained and reviewed during the development of this EA, and is included in Appendix G. Table 4-10 provides a determination of effects for those species based on those activities that could be conducted under the proposed action alternative. WS has determined that the proposed action alternative may affect, but would not likely adversely affect the piping plover and the roseate tern based primarily on the beneficial effects that could occur from reducing predation risks. The USFWS concurred with WS' determination that activities related to nest predator management would not adversely affect piping plovers (L. Nordstrom, USFWS, pers. comm. 2009). A separate Section 7 consultation was conducted relative to the effects of the proposed nest predator program on roseate terns in Maine. The USFWS again concurred with WS' determination that activities related to nest predator management would not adversely affect roseate terns (L. Zicari, USFWS, pers. comm. 2012).

Table 4-10. Federally listed species in Maine, including a determination of effects

Species[†]	Status	Regionally Present?	Proposed Action Effect[‡]
Beetle, American burying	E	NO	NE
Blue, Karner	E	NO	NE
Curlew, Eskimo	E	NO	NE
Lynx, Canada	T	NO	NE
Plover, piping	T	YES	NLTAA
Cougar, eastern	E	NO	NE
Ridley, Atlantic	E	NO	NE
Salmon, Atlantic	E	NO	NE
Sea turtle, leatherback	E	NO	NE
Sea turtle, loggerhead	T	NO	NE
Sturgeon, shortnose	E	NO	NE
Tern, roseate	E	YES	NLTAA
Whale, finback	E	YES	NE
Whale, Humpback	E	YES	NE
Whale, northern right	E	YES	NE
Whale, Sei	E	NO	NE
Whale, Sperm	E	NO	NE
Wolf, gray	E	NO	NE
Lousewort, Furbish's	E	NO	NE
Pogonia, small whorled	T	YES	NE
Orchid, Prairie white-fringed	T	NO	NE

[†]Scientific names for each of the species listed can be found in Appendix G

[‡]NE=No effect; NLTAA=Not Likely to Adversely Affect

In addition, WS has determined the proposed action alternative would have no effect on other T&E species based on the absence of those species in the project areas or based on the use profiles of the methods available to address nest predation.

As part of the development of this EA, WS prepared standard operating procedures to safeguard state T&E species (see Appendix I). WS has received concurrence from the MDIFW on the standard operating procedures (G. Matula, MDIFW pers. comm. 2010).

Alternative 4 – Managing Nest Predation Using Non-lethal Methods Only

A non-lethal management alternative would require WS to only recommend and use non-lethal methods to manage and prevent predation by nest predators. WS would provide technical assistance and direct operational assistance under this alternative recommending and using only non-lethal methods. The non-lethal methods available under this alternative would be the same non-lethal methods identified previously under Issue 2.

As previously stated in Issue 2, non-lethal methods have the potential to cause adverse effects to non-targets, including T&E species, primarily through live-capture, exclusion, harassment, and dispersal. Any exclusionary device erected to prevent access of target species also potentially excludes species that were not the primary reason the exclusion was erected; therefore, T&E species excluded from areas may potentially be adversely affected if the area excluded was large enough. Auditory and visual dispersal methods that could be used to reduce predation risks by nest predators would also likely disperse non-targets in the immediate area the methods were employed. Because of this reason, and the potential impacts to piping plovers, least terns, and roseate terns, auditory and visual deterrents would not be used

in the immediate areas occupied by those species. The use of auditory and visual dispersal methods would have limited applicability under this alternative due to the potential of dispersing nesting terns and plovers from nesting areas if those methods were used in close proximity to nesting locations.

Other non-lethal methods available for use under this alternative include cage traps, foothold traps, cable restraints, and repellents. Cage traps, foothold traps, and cable restraints restrain wildlife once captured and are considered live-capture methods. Cage traps, foothold traps, and cable restraints have a slight potential to capture T&E species. Trap placement in areas where target species were active and the use of target-specific attractants minimizes the capture of non-targets. The type of trap employed and how the trap was set would aid in avoiding T&E species. Trap modifications such as pan tension and loop size would allow non-targets to pass over traps or cable restraints without engaging the trap. Traps and cable restraints would never be set in areas where the presence of T&E species was expected.

Only those repellents registered with the EPA pursuant to the FIFRA would be recommended and used by WS under this alternative. The only repellent currently registered with the EPA is mesurol for use to discourage crows from feeding on the eggs of threatened and endangered species. Mesurol is currently registered for use in Maine. The use and recommendation of repellents would not have negative effects on T&E species when used according to label requirements. Mesurol would be prepared and inserted into eggs that were similar in appearance and size to the eggs of those species being protected; therefore, only those wildlife species that select for eggs and can ingest the eggs treated with mesurol would potentially be affected by the use of mesurol. In addition, mesurol would be used prior to the arrival of nesting terns and plovers to condition crows to avoid feeding on the eggs of those species.

Under this alternative, WS would not be involved with the use of lethal methods to reduce nest predation. Those nest predators addressed in this assessment could continue to be taken during the regulated harvest season, under permits issued by the USFWS and/or the MDIFW, and crows could be lethally taken under the depredation order for blackbirds. Those entities seeking assistance or conducting activities using lethal methods to alleviate nest predation would be responsible for ensuring compliance with the ESA and/or the Maine Endangered Species Act. Risks to T&E species would continue to occur from those persons who implement methods on their own or through recommendations by other federal, State, and private entities.

If non-lethal methods were not available for use by WS, resource managers may attempt to use lethal methods that were available to them, or hire outside entities to perform the work. This could result in less experienced persons implementing methods and could lead to a higher potential for take of T&E species than the proposed action.

Issue 4 - Effectiveness of Methods and Strategies for Alleviating Nest Predation Risks

A common issue when addressing predation risks is the effectiveness of the methods being employed. Methods being employed to resolve nest predation must be effective at resolving predation or the risk of predation within a reasonable amount of time. The issue of method effectiveness as that effectiveness relates to each alternative analyzed in detail is discussed below.

Alternative 1 – No Involvement by WS in Managing Predation Risks

The methods available under this alternative would be similar to those methods that would be available under the other alternatives. The only methods that would not be available under this alternative would be the use of mesurol and DRC-1339. Those methods would be restricted to use by WS only. Immobilizing drugs and euthanasia chemicals are generally not available for use by the public. WS would not be directly involved with application of any methods to resolve nest predation in the State

under this alternative. The recommendation of methods and the use of methods would be the responsibility of other entities. When available methods were employed as intended, a reasonable amount of effectiveness would be expected. If methods were employed incorrectly due to a lack of knowledge in their proper use or if methods were employed without consideration of the behavior of nest predators, those methods being employed would likely be less effective.

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 reduce or prevent nest predation. The use of lethal methods under this alternative would continue to be available. Since WS would not be involved with any aspect of reducing nest predator risks under this alternative, the use of methods and the proper application of methods would occur as decided by those persons employing those methods or by other entities providing assistance.

Alternative 2 – Managing Nest Predation Risks by WS through Technical Assistance Only

Under this alternative, WS would provide technical assistance only through the recommendation of an adaptive integrated approach using those methods available that were deemed appropriate using the WS Decision Model. With WS providing technical assistance but no direct assistance under this alternative, entities requesting assistance from WS could take no action, which means predation or the risk of predation would likely continue or increase in each situation, or implement WS' recommendations for non-lethal and/or lethal methods. Methods of frightening or dispersing nest predators have been effective at specific sites. However, in most instances, those methods simply shift the problem elsewhere (Conover 1984, Aguilera et al. 1991, Swift 1998). Major habitat modifications, while potentially effective, are poorly accepted, not widely employed, and would not be biologically sound. Long-term solutions usually require some form of local population reduction to stabilize or reduce populations of those species in areas where predation was occurring. Removing nest predators from nesting areas would be limited by applicable State and federal laws and regulations, including legal hunting. However, individuals or entities that implement management may not have the experience using a particular method necessary to conduct the actions efficiently and effectively.

Under an alternative in which WS would only provide technical assistance to those persons requesting assistance, those methods described in Appendix B could be recommended and demonstrated, except for mesurol and DRC-1339. The use of immobilizing drugs or euthanasia chemicals would only be recommended to those entities that can legally use those methods. WS would recommend methods using the WS Decision Model based on information provided by those persons requesting assistance or through site visits. WS would describe and demonstrate the correct application of those lethal and non-lethal methods available. If those persons receiving technical assistance apply methods as recommended and demonstrated by WS, those methods, when employed to resolve nest predation, would reasonably be anticipated to be effective in resolving or reducing predation occurring or the threat of predation. Under this alternative, those persons requesting assistance would be provided information on the behavior of nest predators to ensure methods were applied when the use of those methods would likely be most effective. For example, if live-capture of red fox were recommended using foothold traps, WS would provide information to those persons requesting assistance regarding red fox behavior, the appropriate placement of the trap, and the use of lures to ensure the capture of red fox.

The effectiveness of methods under this alternative would be variable to the other alternatives based on the abilities of the individuals performing the work. If methods were employed as intended and with regard to the behavior of nest predators, those methods would likely be effective in resolving predation or the threat of predation. The demonstration of methods and the information provided by WS on nest predator behavior through technical assistance under this alternative would likely increase the effectiveness of the methods employed by those persons requesting assistance. However, if methods were

employed that were not recommended or if those methods were employed incorrectly by those persons requesting assistance, methods could be less effective in resolving predation or threats. In years prior to WS' involvement, the MDIFW observed lower success in removing predators when non-WS entities were employed to reduce nest predation risks (J. Camuso, MDIFW pers. comm. 2012, K. O'Brien, USFWS pers. comm. 2012).

Alternative 3 - Continuing the Current Integrated Approach to Managing Nest Predation (Proposed Action/No Action)

Under the proposed action, WS would continue the use of an adaptive approach using an integration of methods to reduce or prevent nest predation. WS would continue to provide both technical assistance and direct operational assistance to those persons requesting assistance. WS only provides assistance after a request has been received and a cooperative service agreement or other comparable document has been signed by WS and the requesting entity. The cooperative service agreement or other comparable document would specify the methods the requesting entity and WS had agreed upon using to alleviate nest predation risks. WS would employ only those methods as agreed upon by the requestor after available methods were discussed. Methods employed to manage nest predation, whether non-lethal or lethal, would often be temporary with the duration dependent on many factors, including wildlife densities in the area, the availability of suitable habitat in the area, and the availability of methods.

Comments are often received that lethal methods would be ineffective because additional nest predators would likely to return to the area. In addition, comments also claim that because nest predators return to an area after initial removal efforts were completed, the use of lethal methods give the impression of creating a financial incentive to continue the use of only lethal methods. However, those comments assume nest predators only return to an area where predation was occurring if lethal methods were used. The use of non-lethal methods could also be temporary, which could result in nest predators returning to an area where predation was occurring once those methods were no longer used or if nest predators habituate to their use. For example, the most commonly used non-lethal method employed to prevent predation would be exclosures placed around nests. Exclosures can be an effective method of preventing predation on eggs (USFWS 2009). However, chicks and adults often remain vulnerable to predation from a variety of mammalian and avian predators (USFWS 2009, Barber et al. 2010). Harassment of incubating ground nesting birds by nest predators attempting to access exclosures can result in nest abandonment or predation despite the use of exclosures. Chicks that hatch would be vulnerable to avian and mammalian predation once they leave the exclosure to feed. Nest exclosures can fail to stop avian or mammalian predation on eggs or fledglings, or to stop nest abandonment by piping plovers (USFWS 1991) and may increase nest abandonment and predation rates of adults (Johnson and Oring 2002, Barber et al. 2010). In some cases, the number of visitations to nest enclosures by red fox increased each year (USFWS 1991). Some nest predators have learned to associate nest exclosures with active nests (Murphy et al. 2003, Niehaus et al. 2004).

Dispersing predators or preventing access to areas using fencing, or any other non-lethal method addressed in Appendix B often requires repeated application to discourage predators, which increases costs, could potentially move those predators to other areas where they could cause damage, and would be temporary if habitat conditions remain unchanged. Dispersing or translocating nest predators could be viewed as moving a problem from one area to another, which may require addressing damage caused by those predators at another location. In addition, most non-lethal methods (*e.g.*, fencing, enclosures, live-traps) require constant monitoring and maintenance to remain effective. WS' recommendation or use of techniques to modify existing habitat or to make areas unattractive to nest predators 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 nest predation that is agreed upon by the cooperator.

As part of an integrated approach to managing nest predation, WS would have the ability to adapt the widest range of methods to effectively reduce or prevent predation 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 would be to reduce nest predation or to prevent predation from occurring using an integrated approach. Therefore, under the proposed action, WS would employ methods adaptively to achieve that objective.

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 two to eight 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 wildlife are present and must be repeated daily until the desired results are achieved, which can increase the costs associated with those activities. During a six-year project using only non-lethal methods to disperse crows in New York, the number of events required to disperse crows remained similar amongst years and at some locations, the number of events required to harass crows increased from the start of the project (Chipman et al. 2008). Long-term solutions to resolving bird damage often require management of the population (Smith et al. 1999) and identifying the habitat characteristics that attract birds to a particular location (Gorenzel and Salmon 1995).

As addressed previously, the methods available for resolving nest predation would be similar across all the alternatives analyzed, except for the use of mesurol and DRC-1339. Under the proposed action, the use of mesurol and DRC-1339 could occur by WS when deemed appropriate. In addition, the use or recommendation of immobilizing drugs and euthanasia chemicals could be limited under the other alternatives. Alternative 4 would limit the methods employed and/or recommended by WS to non-lethal methods only. However, a majority of methods would be available under all the Alternatives to any entity. If the methods that were similar across the Alternatives were used as intended with consideration for the behavior of the target species, those methods would be considered equally effective.

WS typically institutes an integrated approach that utilizes a broad range of management tools. Lethal methods would be used as a part of an integrated approach when non-lethal methods alone were ineffective. The proposed action has the greatest potential of successfully reducing nest predation and allows those methods determined to be effective when using WS' Decision Model to be applied to resolve requests for assistance. 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[10]. 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 efficacy of WS' activities has been demonstrated during the five years of WS' involvement in protecting piping plovers from nest predators. In those years, the observed fledging rates of piping plover chicks was 58% higher in areas where nest predator risks were addressed as compared to the nesting areas that did not receive predation management (see Table 4-11).

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

Table 4-11. The mean fledging productivity of piping plovers observed on seven beaches in York and Cumberland Counties in Maine 2007-2011

Location	Productivity by Year					mean productivity
	2007	2008	2009	2010	2011	
Crescent Surf Beach	1.00	3.00	3.17	2.33	2.80	2.50
Goose Rocks Beach	1.43	2.14	1.88	1.25	2.57	1.80
Western Beach	3.00	N/A[†]	N/A	0.00	N/A	2.00
Higgins Beach	1.50	N/A	N/A	2.00	0.50	1.20
Goosefare Brook Beach	N/A	1.50	N/A	3.00	4.00	2.50
Ram Island Beach	N/A	N/A	N/A	0.00	N/A	0.00
Ogunquit Beach	N/A	N/A	N/A	1.00	1.67	1.40
Mean with predator management	**1.53**	**2.25**	**2.43**	**1.48**	**2.33**	**1.96**
Mean without predator management	**0.70**	**1.15**	**0.92**	**2.00**	**1.86**	**1.24**

[†]N/A=Information is unavailable

The ability of an animal population to sustain a certain level of lethal removal and to eventually return to pre-management levels does not mean individual management actions were unsuccessful, but that periodic management may be necessary. The return of wildlife to pre-management levels also demonstrates that limited, localized methods have minimal impacts on a species' populations.

Based on the evaluation of each nest predation situation under the proposed action, the most effective methods would be employed individually or in combination based on prior evaluations of methods or combinations of methods in other nest predation 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-making process for each request for assistance based on the continual evaluation of methods and results under WS' Decision Model (see Appendix J).

Alternative 4 – Managing Nest Predation Using Non-lethal Methods Only

A non-lethal management alternative would require WS to only recommend and use non-lethal methods to manage and prevent nest predation. WS would provide technical assistance and direct operational assistance under this alternative recommending and using only non-lethal methods in an integrated approach. Based on an evaluation of the request for assistance, the most effective non-lethal methods would be employed individually or in combination based on prior evaluations of methods or combinations of methods in other nest predation situations. Once employed, non-lethal 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 for each request based on the continual evaluation of methods and results under WS' Decision Model (see Appendix J).

The methods used under this alternative would include all of the non-lethal methods previously identified, including minor habitat modification, visual deterrents, live traps, exclusionary devices, frightening devices, mesurol, Avitrol®, immobilizing drugs, foothold traps, cable restraints, translocation, and nest/egg destruction. WS could operationally employ immobilizing drugs under this alternative; however, WS would only recommend the use of immobilizing drugs to appropriately licensed entities that are authorized to use immobilizing drugs. Those methods available to WS under this alternative would also be available for use by other entities under the other alternatives. The only method that would not be available for use by other entities would be the avian repellent mesurol, which is only available to WS to reduce egg predation by crows. The effectiveness of non-lethal methods under this alternative would be

similar to the effectiveness of those non-lethal methods described under the proposed action alternative, since those same methods would be available to WS under this alternative.

Under this alternative, all live-captured target wildlife would be translocated to alleviate predation risks. Therefore, translocation sites would have to be identified and approved by the MDIFW and/or the USFWS prior to live-capture. Live-captured wildlife would only be translocated and released onto properties containing appropriate habitat for the species and would only be released after the owner or manager of the property had authorized the release of animals. Because the policy of the MDIFW restricts the translocation of red fox, raccoons, and striped skunks beyond five miles, it is likely that some translocated animals could return to the nesting areas and cause additional threats. In some cases, wildlife that were live-captured and released become extremely wary and more difficult to live-capture using similar methods. Since all target wildlife species live-captured would be translocated, there could be increased costs associated with properly handling and transporting live-captured target species to translocation sites depending on the distances transported. Similar to the other alternatives, wildlife translocated could be replaced by other nest predators. For predatory mammals, immobilizing drugs could be used to sedate and calm animals during transport. Sedating and calming animals being transported would help ensure the safety of the animal and ensure the safety of the handlers.

Live-capturing and translocating wildlife away from nesting areas could also have negative consequences by increasing the likelihood of disease transmission, stress, and mortality on translocated animals. In addition, negative consequences (*e.g*., competition for resources, disease transmission) to other animals at or near release sites could occur. Translocated animals could also cause damage or pose a threat in the areas where they were released (Craven et al. 1998).

Red fox, gray fox, coyotes, raccoons, opossum, skunks, mink, weasels, and crows could still be lethally taken during the regulated harvest season and as permitted by the MDIFW under this alternative. Gulls, kestrels, merlins, and great horned owls could still be addressed using lethal methods by other entities pursuant to permits issued by the MDIFW and the USFWS. Crows could be addressed using lethal methods by other entities under this alternative pursuant to the blackbird depredation order. Feral cats, feral dogs, and chipmunks could also be lethally removed by other entities at anytime those species were posing a threat of nest predation. Although non-lethal methods can be effective at reducing nest predation, the use of non-lethal methods only may not be practical in all situations (*e.g*., placing fencing around entire nest colonies to exclude predators would be cost prohibitive).

Issue 5 - Effects of Management Methods on Human Health and Safety

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

Safety of Chemical Methods Employed

Alternative 1 – No Involvement by WS in Managing Predation Risks

Under the no involvement by WS alternative, WS would not be involved with any aspect of managing predation risks associated with nest predators, including technical assistance. Due to the lack of involvement in managing nest predation, no effects to human safety would occur directly from WS. This alternative would not prevent other entities from conducting activities to reduce nest predation in the absence of WS' assistance.

The only chemical methods that would be available to other entities that could be employed to reduce nest

predation risks under this alternative would be the flock-dispersing agent known as Avitrol®, gas cartridges, and carbon dioxide for euthanizing live-captured animals. In addition, immobilizing drugs and euthanasia chemicals could be used by appropriately licensed individuals under this alternative. Chemical methods are further described in Appendix B.

Avitrol® (4-aminopyridine) is a restricted use pesticide that could only be purchased and applied by appropriately authorized entities. Avitrol® is a registered flock dispersal method that is labeled for the control of crows in, on, or in the area of structures, feeding, nesting, and roosting sites. Avitrol® is registered in Maine to manage damage associated with crows. Risks to human safety from the use of Avitrol® could occur through either direct exposure to the chemical or exposure to the chemical from crows that have ingested Avitrol®.

Formulations of Avitrol® are commercially available and can be purchased pre-applied to whole corn. Adherence to label requirements during the handling and application of Avitrol® for use of personal protective equipment would ensure the safety of the public handling and applying treated bait. Therefore, risks to handlers and applicators that adhere to the personal protective equipment requirements of the label would be low. Before application at bait locations, treated bait would be mixed with untreated bait at ratios required by the product label, generally 1:9 (treated:untreated), to minimize non-target hazards and to avoid bait aversion by target species.

Crows that consume Avitrol® treated bait may react and elicit abnormal behaviors, which usually frighten other birds in the area away. Birds that ingest treated bait usually die. Of additional concern, is the potential exposure of people to crows harvested during the regulated hunting season that have ingested Avitrol®. The hunting season for crows in the State during the development of this assessment occurred from late January/early February through late March/mid-April depending on the wildlife management district, with no daily take limit and no possession limit (MDIFW 2012). If other entities were to use Avitrol® to reduce risks of crow predation, baiting could occur in the State during the period of time when crows could be harvested.

For a crow that ingested Avitrol® 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 Avitrol® and subsequently consume certain portions of the crow. The mode of action of Avitrol® requires ingestion by crows so handling a crow harvested or found dead would not pose any primary risks to human safety.

Factors that reduce exposure risks to members of the public from use of this product are:

- A human would have to ingest the internal organs of birds found dead from Avitrol® ingestion to have any chance of receiving even a minute amount of the chemical or its metabolites into their system. This is highly unlikely to occur. Furthermore, secondary hazard studies with mammals and birds have shown that there is virtually no hazard of secondary poisoning.
- Although Avitrol® has not been specifically tested as a cancer-causing agent, the chemical was found not to be mutagenic in bacterial organisms. Therefore, the best scientific information available indicates it is not a carcinogen. Notwithstanding, the extremely controlled and limited circumstances in which Avitrol® is used would prevent exposure of members of the public to this chemical.

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 Avitrol®. Hunting and discharging a firearm is prohibited in many nesting areas, as well as in most municipal areas. Therefore, a crow would have to ingest treated bait and then travel to an area (typically outside the nesting area or city limit) where hunting was allowed. Secondly, to pose a risk to human safety, the crow would have to be

consumed and the tissue consumed would have to contain chemical residues. Avitrol® is highly toxic to birds when ingested, and the effects of toxicity occur almost immediately after ingestion; therefore, those birds affected by Avitrol® would not likely be available to be shot by hunters. Although no information is currently available on the number of people that might consume crows in Maine, very few, if any, people are likely consuming crows harvested in Maine or elsewhere. Crows are harvested for recreational purposes and are lethally taken to alleviate damage in the State. Crows are not harvested for subsistence (B. Allen, MDIFW pers. comm. 2011). If a crow were harvested and consumed, the greatest risk would occur if a person consumed undigested treated bait from the digestive tract of a crow that died after consuming treated bait. The digestive tract of harvested game species is usually discarded by the hunter and not consumed. Therefore, given the label requirements, the locations where treated baits would be used to reduce nest predation, and the unlikelihood of people consuming crows, the risk to human safety from harvesting crows ingesting treated bait would be extremely low.

Carbon dioxide gas used to euthanize an animal inside a chamber would pose minimal hazards to people when used appropriately. Risks associated with the use of immobilizing drugs and euthanasia chemicals would be similar to those described under the proposed action alternative. Gas cartridges would be placed inside of burrows or dens and ignited. The entrance of the burrow or den would then be covered with dirt, which traps carbon monoxide inside the burrow. The carbon monoxide produced would dissipate into the atmosphere and be diluted by the air (EPA 1991). If label instructions were followed when employing gas cartridges, no risks to human safety would occur from the use of gas cartridges.

Alternative 2 – Managing Nest Predation Risks by WS through Technical Assistance Only

Under this alternative, WS would be restricted to making recommendations of methods and the demonstration of methods only to resolve nest predation. WS would only provide technical assistance to those persons requesting assistance. Under a technical assistance only alternative, the use of DRC-1339 and mesurol would not be available to the public. Similar to Alternative 1, those chemical methods that would be available for use by other entities under this alternative would include Avitrol®, gas cartridges, and carbon dioxide. In addition, immobilizing and euthanasia chemicals would be available for appropriately licensed individuals. Hazards to human safety associated with the use of those chemical methods would be similar to those risks addressed under Alternative 1.

Alternative 3 - Continuing the Current Integrated Approach to Managing Nest Predation (Proposed Action/No Action)

Chemical methods currently available under the proposed action would include the repellent mesurol, the avicide DRC-1339, the chemical frightening agent Avitrol®, carbon dioxide for euthanasia, immobilizing drugs, euthanasia chemicals, and the large gas cartridge. The use of carbon dioxide, gas cartridges, and Avitrol® could also occur by other entities under this alternative. The risks to human safety from the use of Avitrol®, gas cartridges, and carbon dioxide by WS and by other entities under this alternative would be similar to those risks described under Alternative 1. WS would follow all instructions on the pesticide label to ensure risks to human safety were low. Chemical methods are further described in Appendix B.

Risks associated with the use and application of Avitrol® and gas cartridges by WS would be similar to those risks described under Alternative 1. Adherence to label requirements during the handling and application of Avitrol® and gas cartridges would ensure the safety of WS' employees and the public when handling and applying those methods. WS would adhere to all label requirements for use of personal protective equipment. Therefore, risks to handlers and applicators that adhere to the personal protective equipment requirements of the label would be low.

Mesurol is registered by the EPA for use to condition crows not to feed on the eggs of T&E species.

Mesurol is currently registered for use by WS in Maine. Mesurol contains the active ingredient methiocarb, which would be mixed with water and once mixed, placed inside raw eggs that were similar in size and appearance to the eggs of the species being protected. Treated eggs would be placed in the area where the protected species were 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 when ingested in small dosages. Crows ingesting treated eggs become sick (*e.g.*, regurgitate, become lethargic); however, they generally recover. In accordance with the label, warning signs would be posted in areas where treated eggs would be placed. If left undisturbed, treated eggs would pose minimal risks to human safety. In addition, the storage and disposal of the chemical and treated eggs would occur in accordance with the label. Human safety risks associated with the use of mesurol would 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.

Like Avitrol® and mesurol, risks to human safety from the use of avicides could occur through either direct exposure to the chemical or exposure to the chemical from birds that have been lethally taken. The only avicide currently registered for use in Maine is DRC-1339 (3-chloro-p-toluidine hydrochloride) that could be used for crow and/or gull damage management. DRC-1339 is currently registered with the EPA to manage damage associated with several other bird species and can be formulated on a variety of bait types depending on the label. For use on crows and gulls, technical DRC-1339 (powder) must be mixed with water or margarine, and in some cases, a binding agent (required by the label for specific bait types). When targeting crows, the technical DRC-1339, water, and binding agent, if required, would be mixed, and then the liquid would be poured over the bait and mixed until the liquid was absorbed and evenly distributed. The treated bait would then be allowed to air dry. When targeting gulls, technical DRC-1339 would be mixed with melted stick margarine and spread onto sandwich bread. The mixing, drying, and storage of DRC-1339 treated bait would occur in controlled areas that were not accessible by the public. Therefore, risks to public safety from the preparation of DRC-1339 would be 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 would be low. Before application at bait locations, treated bait would be 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: 1) product label requirements (*e.g.*, distance from water, specific location restrictions); 2) the target bird species use of the site (determined through prebaiting and an acclimation period): 3) non-target use of the area (areas with non-target activity are not used or abandoned); and 4) 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 feedings stations or would be broadcast using mechanical methods (ground-based equipment or hand spreaders) and by manual broadcast (distributed by hand) per label requirements. Once baited using the diluted mixture (treated bait and untreated bait), when required by the label, locations would be monitored for non-target activity and to ensure the safety of the public.

After each baiting session, all uneaten bait would be retrieved. Through prebaiting, target birds can be acclimated to feed at certain locations at certain times. By acclimating birds to a feeding schedule, baiting can 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 allows treated bait to be placed at a location only when target birds were conditioned to be present at the site and

provides a higher likelihood that treated bait would be consumed by the target species, which makes it unavailable 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 were 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 treated bait, and then handled that treated bait. Finally, WS' personnel monitor sites according to the label to ensure that non-targets or people do not contact the treated bait.

Factors that would minimize any risk of public health problems from the use of DRC-1339 would be: 1) its use is prohibited within 50 feet of standing water and cannot be applied directly to food or feed crops (contrary to some misconceptions, DRC-1339 is not applied to feed materials that livestock can feed upon), 2) DRC-1339 is highly unstable and degrades rapidly when exposed to sunlight, heat, or ultraviolet radiation (the half-life is about 25 hours; in general, DRC-1339 on treated bait material is almost completely broken down within a week if not consumed or retrieved); 3) the chemical is more than 90% metabolized in target birds within the first few hours after they consume the bait (therefore, little material is left in bird carcasses that may be found or retrieved by people); 4) application rates are extremely low (EPA 1995); 5) a human would need to ingest the internal organs of birds found dead from DRC-1339 to be exposed; and 6) the EPA has concluded that, based on mutagenicity (the tendency to cause gene mutations in cells) studies, this chemical is not a mutagen or a carcinogen (*i.e.*, cancer-causing agent) (EPA 1995).

When managing predation risks associated with crows or gulls, the use of DRC-1339 would likely occur at known forage areas, nesting areas, or in areas where crows or gulls have been conditioned to feed using prebaiting. Baiting with DRC-1339 treated baits when targeting crows most often occurs during the winter or early spring 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 or gulls that consume treated bait could fly long distances. Although not specifically known for crows or gulls, sensitive bird species that ingest a lethal dose of DRC-1339 treated bait generally die within 24 to 72 hours after ingestion (USDA 2001*b*). Therefore, crows and gulls 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.

Although not specifically known for crows and gulls, in other sensitive species, DRC-1339 is metabolized and/or excreted quickly once ingested. When starlings were administered dosages of DRC-1339 that were well above the LD_{50} for starlings, nearly 90% of the DRC-1339 administered 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 examined (Giri et al. 1976, Cunningham et al. 1979, Johnston et al. 1999), with residues diminishing more slowly in the kidneys (Eisemann et al. 2003). However, most residue tests to detect DRC-1339 in tissues of birds have been completed using DRC-1339 dosages that far exceeded the known acute lethal oral dose for those species tested and far exceeded 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 ≤ 1 mg/kg that was 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 tract nor found in breast tissue (Johnston et al. 1999).

In summary, nearly all of the DRC-1339 ingested by sensitive species would be 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. Residue of DRC-1339 ingested by birds appears to be primarily located in the gastrointestinal tract of birds.

Similar to Avitrol®, of additional concern is the potential exposure of people to crows harvested during the regulated hunting season that have ingested DRC-1339 or mesurol-treated bait. Risks to human safety associated with harvesting crows that may have consumed Avitrol® would be similar to those described previously under Alternative 1 and would be considered low.

The hunting season for crows in the State, during the development of this assessment, occurred from late January/early February through late March/mid April depending on the wildlife management district, with no daily take limit and no possession limit (MDIFW 2012). A second hunting season occurred from early August to late September, with no daily take limit and no possession limit (MDIFW 2012). Under the proposed action, baiting using DRC-1339 or mesurol to reduce crow predation could occur in the State during the period of time when crows could be harvested.

For a crow that ingested DRC-1339 or mesurol-treated bait to pose a potential risk to human safety from someone harvesting crows during the hunting season in the State, a hunter would have to harvest a crow that ingested DRC-1339 or mesurol-treated bait and subsequently consume certain portions of the crow. The mode of action of DRC-1339 or mesurol requires ingestion by crows so handling a crow harvested or found dead would not pose any primary risks to human safety.

Very little information is available on the acute or chronic toxicity of DRC-1339 or mesurol on people. However, based on the information available, risks to human safety would be extremely low based on several mitigating factors. First, a hunter would have to harvest a crow that had ingested DRC-1339 or mesurol. As stated previously, the use of DRC-1339 or mesurol would primarily occur to address predation near beach nesting areas. Hunting and discharging a firearm is prohibited in many nesting areas, as well as in most municipal areas. Therefore, a crow would have to ingest treated bait and then travel to an area (typically outside the nesting area or city limit) where hunting was allowed. WS would not recommend hunting as a management tool in those general areas where DRC-1339 or mesurol were actively being applied. Secondly, to pose a risk to human safety the crow would have to be consumed and the tissue consumed would have to contain chemical residues.

Current information indicates that the majority of the DRC-1339 is excreted within a few hours of ingestion, and the highest concentration of the chemical occurs in the gastrointestinal tract of the bird, which would be discarded and not consumed. Mesurol is also highly toxic to birds; however, when used according to labeling guidelines, only small doses are used, and the effect on crows that ingest one egg is typically limited to dyspepsia or lethargy, and not death. Mesurol has been used in the past as a chemical repellent to protect fruit and vegetables from bird consumption (Benjamini 1980, Noble 1980). Because doses that affect crows are low, this decreases the likelihood of secondary poisoning to people. Mesurol would be used just prior to nest initiation of threatened and endangered shorebirds, which usually occurs in May or June. Crow hunting season ends in mid-April. Mesurol, DRC-1339, or Avitrol® applications could be timed so that they were outside of the hunting season for crows. Still, if they did occur during the hunting season, as noted above, most crow hunters do not consume the meat.

Although DRC-1339 residues have been detected in the tissues that might be consumed, residues appear to only be detectable when the bird has consumed a large 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 Maine, very few, if any,

people are likely consuming crows harvested in Maine or elsewhere. Crows are harvested for recreational purposes and are not harvested for subsistence (B. Allen, MDIFW pers. comm. 2011).

Human consumption of gulls is not known to occur. Because gulls are protected under the MBTA, a depredation permit would be required to kill them. Standard conditions that pertain to depredation permits do not allow consumption (they must be buried or incinerated); therefore, human consumption of gulls would not be expected or likely; therefore, DRC-1339 exposure to humans by consuming gulls is unlikely.

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

All WS' personnel who handle avicides and repellents would be properly trained. Training and adherence to agency directives would ensure the safety of employees administering any chemical methods. Nest predators killed with chemical methods would be disposed of by deep burial or incinerated to ensure the risks to human safety from euthanized wildlife were minimal (see WS Directive 2.515). Chemical applications would occur, to the greatest extent possible, in the absence of the public to further minimize risks. SOPs that further reduce risks to human safety are described in Chapter 3 of this EA.

The use of immobilizing drugs would only be administered to mammals that have been live-captured using other methods. Immobilizing drugs used to sedate wildlife would be used to temporary handle and transport animals to lessen the distress of the animal from the experience and for the safety of handlers. Drug delivery to immobilize mammals would likely occur on site with close monitoring of the animal to ensure proper care. Immobilizing drugs would be fully reversible with a full recovery of sedated animals occurring. A list and description of immobilizing drugs available for use under the identified alternatives can be found in Appendix B.

Euthanizing chemicals would be administered under similar circumstances to immobilizing drugs under the relevant proposed alternatives. Euthanizing drugs would be administered to animals live-captured using other methods. Euthanized animals would be disposed of in accordance with WS Directives and therefore, would not be available for harvest and consumption. If mammals were immobilized for translocation and released, risks could occur to human safety if harvest and consumption occurred. SOPs employed by WS to reduce risks those risks are discussed in Chapter 3 and in Appendix B.

Drugs used in capturing, handling, and euthanizing wildlife include ketamine, a mixture of ketamine/xylazine, sodium pentobarbital, potassium chloride, and Beuthanasia-D. Meeting the requirements of the AMDUCA should prevent any adverse effects on human health with regard to this issue. SOPs would include:

- All drug use in capturing and handling wildlife would be under the direction and authority of state veterinary authorities, either directly or through procedures agreed upon between those authorities and WS.
- As determined on a state-level basis by those veterinary authorities (as allowed by AMDUCA), programs may choose to avoid capture and handling activities that utilize immobilizing drugs within a specified number of days prior to the hunting or trapping season for the target species to avoid release of animals that may be consumed by hunters prior to the end of established withdrawal periods for the particular drugs used. Ear tagging or other marking of animals drugged and released to alert hunters and trappers that they should contact state officials before consuming the animal.

- Most animals administered drugs would be released well before controlled hunting/trapping seasons, which would give the drug time to completely metabolize out of the animals' systems before they might be taken and consumed by humans. In some instances, animals collected for control purposes would be euthanized when they are captured within a certain specified time period prior to the legal hunting or trapping season to avoid the chance that they would be consumed as food while still potentially having immobilizing drugs in their systems.

By following those procedures in accordance with the AMDUCA, wildlife management programs would avoid any significant impacts on human health with regard to this issue.

All WS' personnel that handle and administer immobilizing drugs or euthanasia chemicals 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. Wildlife 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 minimize risks, whenever possible. SOPs are further described in Chapter 3 of this EA.

No adverse effects to human safety have occurred from WS' use of chemical methods to alleviate nest predation in Maine from FY 2007 through FY 2011. The risks to human safety from the use of chemical methods, when used appropriately and by trained personnel, would be considered low.

Alternative 4 – Managing Nest Predation Using Non-lethal Methods Only

Under an alternative where only non-lethal methods could be used, the only chemical methods that would be available during direct operational assistance would be mesurol and immobilizing drugs. Mesurol can only be used by WS' personnel; therefore, mesurol would not be recommended or available for use to those persons requesting assistance when WS provides technical assistance under this alternative.

Risks to human safety from the use of available chemical methods by WS under this alternative would be similar to those addressed in the proposed action alternative (Alternative 3) when WS provides direct operational assistance. When WS provides technical assistance, the risks to human safety associated with the available chemical methods would be similar to the technical assistance only alternative (Alternative 2).

Safety of Non-Chemical Methods Employed

Alternative 1 – No Involvement by WS in Managing Predation Risks

Under the no involvement by WS alternative, WS would not be involved with any aspect of managing nest predation in the State, including technical assistance. Due to the lack of involvement in managing nest predation, no impacts to human safety from the use of non-chemical methods by WS would occur directly. This alternative would not prevent other entities from conducting activities to alleviate nest predation in the absence of WS' involvement when permitted by the USFWS and/or the MDIFW. Non-chemical methods discussed in Appendix B would be available for use and could be used to kill nest predators if permitted by the USFWS and/or the MDIFW. The direct burden of implementing permitted methods would be placed on those persons attempting to reduce predation risks.

Since non-chemical methods available to resolve or prevent predation would be available to anyone, the threats to human safety from the use of those methods would be similar between the alternatives. However, methods employed by those persons not experienced in the use of methods or who were 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.

Alternative 2 – Managing Nest Predation Risks by WS through Technical Assistance Only

Under the technical assistance alternative, WS would only recommend the use of available non-chemical methods for managing predation risks caused by nest predators. Recommendations would be made based on the appropriate decision-making process and on information provided by the requester or from a site visit. The implementation of non-chemical methods would be the sole responsibility of the requester. WS would not be directly involved with managing predation risks caused by nest predators in the State. Non-chemical methods available for use under the technical assistance only alternative are addressed in Appendix B.

The non-chemical methods discussed in Appendix B would be available for use under all the alternatives. Therefore, the risks to human safety under a technical assistance alternative would be similar to those risks under the no involvement by WS alternative (Alternative 1), the proposed action alternative (Alternative 3), and the non-lethal methods only alternative (Alternative 4) if methods were applied appropriately and in consideration of human safety.

Risks to human safety associated with non-chemical methods such as resource management methods (*e.g.*, limited habitat modification, modification of human behavior), exclusion devices, frightening devices, and live-capture methods would be considered low based on their use profile for alleviating predation risks associated with wildlife. 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, those methods can be used with a high degree of safety.

The recommendation by WS that nest predators be harvested during the regulated hunting and trapping seasons would not increase risks to human safety above those risks already inherent with hunting and trapping. Recommendations of allowing hunting or trapping on property owned or managed by a cooperator to reduce localized populations of target nest predators, which could then reduce predation or threats, would not increase risks to human safety. Safety requirements established by the USFWS and the MDIFW for the regulated hunting and trapping seasons would further minimize risks associated with those activities. Although hunting and trapping accidents do occur, the recommendation of allowing hunting and trapping to reduce localized nest predator populations would not increase those risks.

The recommendation of shooting with firearms as a method of direct lethal take could occur under this alternative. Safety issues due arise related to misusing firearms and the potential human hazards associated with firearms use when employed to reduce predation risks. When used appropriately and with consideration for human safety, risks associated with firearms would be 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 nest predation would be available under any of the alternatives and the use of firearms 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 when WS provides technical assistance. 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 non-chemical methods available to alleviate nest predation could threaten human safety. However, when used appropriately methods available to alleviate predation would not threaten human safety.

Alternative 3 - Continuing the Current Integrated Approach to Managing Nest Predation (Proposed Action/No Action)

The non-chemical methods available under an integrated approach would be the same as those methods available under all the alternatives, when permitted by the USFWS and/or the MDIFW. When requested under this alternative, WS would directly employ methods to alleviate or prevent nest predation from occurring in the State. WS would also recommend non-chemical methods as part of a technical assistance program in an integrated approach to managing predation. WS' required training and directives ensure that those persons employing methods would be properly trained and knowledgeable in the use of those methods. WS' would use the Decision Model to determine the appropriate method or methods that would effectively resolve the request for assistance. Those methods would be continually evaluated for effectiveness and if necessary, additional methods could be employed. Non-lethal and lethal methods could be used or recommended under the proposed action. WS would continue to provide technical assistance and/or direct operational assistance to those persons seeking assistance with managing nest predation. 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 by WS would be similar to those risks addressed in the other alternatives.

Non-chemical methods available for use under this alternative are discussed in Appendix B. Most non-chemical methods involve the harassment or live capturing of nest predators. Many non-chemical methods would only be activated when triggered. Therefore, if left undisturbed, risks to human safety would be minimal. Although some risks from harassment methods may occur, those risks would be minimal when those methods were used appropriately and as intended. Firearms may also pose a risk to human safety when not handled or applied appropriately. All methods would be employed in areas where human activities would be minimal, when possible. WS would continue to employ methods according to all SOPs described in Chapter 3.

One factor that would further reduce the risks to human safety when WS was directly involved with applying those methods would be the knowledge and training received by WS' personnel. WS' employees who would conduct activities would be knowledgeable in the use of methods, wildlife species responsible for predation, 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 nest predation. When employing lethal methods, WS' employees would consider risks to human safety when employing those methods based on location and method. Consideration would also be given to the location where activities would be conducted based on property ownership. If locations where methods would be employed occur on private property in rural areas where access to the property can be controlled and monitored, the risks to human safety from the use of methods would likely be less. If activities were to occur at parks or near other public use areas, then risks of the public encountering methods and the corresponding risk to human safety increases.

Safety issues may arise from the misuse of firearms and the potential human hazards associated with firearm use when employed to reduce predation risks. To help ensure safe use and awareness, WS' employees who use firearms to conduct official duties would be required to attend an approved firearms safety-training course. The use of firearms by WS' employees would occur pursuant to WS Directive

2.615. As a condition of employment, WS' employees who carry and use firearms are subject to the Lautenberg Domestic Confiscation Law, which prohibits firearm possession by anyone who has been convicted of a misdemeanor crime of domestic violence (18 USC § 922(g)(9)). A safety assessment based on site evaluations, coordination with cooperating and local agencies (if applicable), and consultation with cooperators would be conducted before firearms were deemed appropriate to alleviate or reduce predation risks when conducting activities. WS and cooperating agencies would work closely with cooperators requesting assistance to ensure all safety issues were considered before firearms were deemed appropriate for use. After evaluation of the predation risk associated with the request for assistance using the WS' Decision Model, the WS employee would determine which methods were appropriate for reducing risks at that particular location based on information provided and requested from the requesting entity. Those methods determined to be appropriate to resolve the request for assistance would be agreed upon with the cooperator to ensure the safe use of those methods prior to the application of those methods. Only those methods agreed upon through a MOU, cooperative service agreement, or other comparable agreement would be employed to resolve a particular request for assistance.

The use of restraining devices has also been identified as a potential issue. Restraining devices include cage traps, cable restraints, and foothold traps. Those devices pose minimal risks to the public when used appropriately. Restraining devices would typically be set in areas where human activity was minimal to ensure public safety. Restraining devices rarely cause serious injury and are triggered through direct activation of the device. Therefore, human safety concerns associated with restraining devices used to capture wildlife require direct contact to cause bodily harm. If restraining devices were left alone, those methods pose no risks to human safety outside of those risks associated to the person or persons applying the method. Again, restraining devices would not be located in high-use areas to ensure the safety of the public and pets, whenever possible. Most federally owned lands would be closed to human access during the nesting season, although bird monitors and WS' personnel would be allowed to work in those areas. The closure of nesting areas would further reduce risks to human safety from the use of non-chemical methods.

Alternative 4 – Managing Nest Predation Using Non-lethal Methods Only

Under a non-lethal only alternative, WS would be restricted to the use and recommendation of non-lethal methods only to resolve predation. WS would continue to provide technical assistance and direct operational assistance to those persons requesting assistance with managing nest predation. Although hazards to human safety from non-lethal methods exist, those methods would generally be regarded as safe when used by personnel trained and experienced in their use. Risks to human safety associated with non-chemical methods such as resource management methods (*e.g.*, habitat modification, modification of human behavior), exclusion devices, frightening devices, foothold traps, and cage traps would be considered low based on their use profile for alleviating damage associated with wildlife. 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. Those non-lethal methods available under this alternative would also be available under the other alternatives. The risks to human safety from the use of those methods would be similar across the alternatives.

Issue 6 - Effects on the Socio-cultural Elements of the Human Environment

People often enjoy viewing, watching, and knowing predators exist as part of the natural environment and gain aesthetic enjoyment in such activities. Those methods available to alleviate nest predation would be intended to disperse and/or remove those predators predating on eggs, nestlings, and adults. Non-lethal methods would be employed to exclude or otherwise make an area less attractive, which disperses those animals to other areas. Similarly, the use of lethal methods would be intended to remove those individual

animals identified as posing a predation risk. The effects on the aesthetic value of those species as it relates to the alternatives are discussed below.

Alternative 1 – No Involvement by WS in Managing Predation Risks

Under the no involvement by WS alternative, the actions of WS would have no impact on the aesthetic value of nest predators in the State. Those entities seeking to reduce nest predation risks would be responsible for researching, obtaining, and using all methods as permitted by federal, State, and local laws and regulations. Nest predators could continue to be dispersed and lethally taken under this alternative in the State by state, federal, and/or private entities. Lethal take could continue to occur during the regulated harvest season, pursuant to depredation permits issued to take birds, through the blackbird depredation order (for crows), through permits issued by the MDIFW, and in some cases, without the need for a permit.

Because nest predators could continue to be taken under this alternative, despite WS' lack of involvement, the ability to view and enjoy those predators in areas where predation was occurring would likely be similar to the other alternatives. The lack of WS' involvement would not result in a reduction of the number of nest predators dispersed or taken since WS' has no authority to regulate take or the harassment of those animals in the State. The USFWS and the MDIFW have management authority over those wildlife species addressed in this EA and would continue to adjust all take levels based on population objectives for those species along with the meeting the need to reduce nest predation. Therefore, the number of nest predators lethally taken annually through hunting, trapping, and to alleviate damage, including alleviating nest predation, would be regulated by the USFWS and/or the MDIFW.

Because activities associated with reducing nest predation risks could continue by other entities, it is possible that the take of nest predators could remain the same as the proposed take levels address under the proposed action alternative. Therefore, WS' involvement in alleviating nest predation risks would not be additive to those target species that could be taken in the State. The impacts to the aesthetic value of nest predators would be similar to the other alternatives.

Alternative 2 – Managing Nest Predation Risks by WS through Technical Assistance Only

If those persons seeking assistance from WS were those persons likely to conduct nest activities in the absence of WS' involvement, then technical assistance provided by WS would not adversely affect the aesthetic value of those nest predators in the State similar to Alternative 1. Nest predators could be lethally taken under this alternative by other entities besides WS, which would result in localized reductions in the presence of those species at the location where nesting was occurring. The presence of predators in areas where predation was occurring or could occur would be reduced where activities were conducted under any of the alternatives. Even the recommendation of non-lethal methods would likely result in the dispersal of nest predators from the area if those non-lethal methods recommended by WS were employed by those persons receiving technical assistance. Therefore, technical assistance provided by WS would not prevent the aesthetic enjoyment of nest predators since any activities conducted to alleviate predation 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 individual nest predators would be similar to those effects addressed in the proposed action. When entities seek assistance with managing predation risks from either WS or another entity, the level of predation has often reached an unacceptable threshold that is causing lower than desired reproductive success. Therefore, in the case of alleviating risks of nest predation, the acceptance level of those nest predators has reached a level where assistance has been requested and those persons are likely to apply methods or seek those entities that would apply those

methods based on recommendations provided by WS or by other entities. Based on those recommendations, methods would likely be employed by the requestor that would result in the dispersal and/or removal of nest predators. If those nest predators were dispersed or removed by those persons based on recommendations by WS or other entities, the potential effects on the aesthetic value of those individual nest predators would be similar to the proposed action alternative.

The potential impacts on aesthetics from a technical assistance program would only be lower than the proposed action if those individuals seeking assistance with alleviating nest predation were not as diligent in employing those methods as WS. If those persons abandoned the use of those methods, then nest predators would likely remain in the area and available for viewing and enjoying for those persons interested in doing so; however, risks of nest predation would likely remain the same or increase. Similar to the other alternatives, the geographical area in which activities could occur would not be such that nest predators would be dispersed or removed from such large areas that opportunities to view and enjoy individuals of a species would be severely limited since most species identified as nest predators can be found statewide in suitable habitat.

Alternative 3 - Continuing the Current Integrated Approach to Managing Nest Predation (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 nest predators to resolve threats. In some instances where nest predators were dispersed or removed, the ability of interested persons to observe and enjoy those individual animals would likely temporarily decline in the area where those predators were dispersed or removed. Studies in human dimensions have revealed public attitudes regarding predators and their management to enhance avian recruitment. Messmer et al. (1999) determined that survey participants supported predator control to enhance most avian recruitment, and that support was even greater when prey species were threatened with extinction. Additionally, public attitudes vary dramatically depending on the charismatic nature of the offending predator.

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

The use of lethal methods could result in temporary declines in local populations resulting from the removal of predators to address nest predation. The goal under the proposed action would be to respond to requests for assistance and to manage those individual animals responsible for nest predation or posing a threat of nest predation. Therefore, the ability to view and enjoy those species would remain if a reasonable effort were made to locate those species outside the area in which predation management activities occurred. Those nest predators removed by WS would be those individual animals that could be removed by other entities. Nest predators could be removed pursuant to the appropriate permit issued by the MDIFW for mammalian predators, under depredation permits issued for the take of birds by the USFWS and/or the MDIFW, under the blackbird depredation orders for crows, or during the regulated harvest seasons for those species that can be harvested during hunting and trapping seasons.

Activities would only be conducted by WS after receiving a request for assistance and only after an agreement for such services had been agreed upon by the cooperator. Some aesthetic value would be gained by the removal of nest predators and the return of a more natural environment, including the return of native wildlife species that may be suppressed or displaced by high densities of nest predators, including nesting T&E species. Any removal of nest predators by WS using lethal methods in the State would occur after the appropriate permits were received, when necessary.

Since those nest predators dispersed or removed by WS under this alternative could be dispersed or removed through a permit issued to the resource owner/manager, removed under depredation orders, or removed during the hunting and/or trapping season, WS' involvement in taking those nest predators would not likely be additive to the number of those species that could be taken in the absence of WS' involvement. In many cases, WS acts as the agent of the property owner or manager under a permit issued to the owner or manager. In those cases, the take of nest predators could occur by the property owner or manager and WS' actions would not be additive to the number of predators that could be taken in the absence of WS' involvement.

The proposed action utilizes an integrated strategy that follows the WS Decision Model (see Appendix I). The model was designed to provide maximum flexibility when choosing management methods. WS' employees would evaluate the appropriateness of strategies, and methods would be evaluated for their availability (*e.g.*, legal and administrative) along with their suitability based on biological, economic, environmental, and social considerations. Following the thought process, the methods deemed practical for the situation would be developed into a management strategy; therefore, various inputs including local concerns (*e.g.*, landowner or residents) are fully evaluated prior to a decision.

WS' take of nest predators from FY 2007 through FY 2011 was of low magnitude when compared to the statewide mortality from other sources and based on population estimates. WS' activities would not likely be additive to the nest predators that could be taken in the absence of WS' involvement. Although individual animals dispersed or removed by WS would no longer be present for viewing or enjoying, those animals could be dispersed or removed by the property owner or manager under the permit issued to the owner or manager by the MDIFW, through depredation permits issued by the USFWS, through the depredation order, or during hunting and trapping seasons. Given the limited take proposed by WS under this alternative when compared to the known sources of mortality of nest predators, WS' activities conducted pursuant to the proposed action would not adversely affect the aesthetic value of those species. The impact on the aesthetic value of nest predators and the ability of the public to view and enjoy those species under the proposed action would be similar to the other alternatives and would likely be low.

Alternative 4 – Managing Nest Predation Using Non-lethal Methods Only

Under this alternative, WS would only use methods that would result in the exclusion, harassment, dispersal, and translocation of nest predators from areas where predation risks were occurring. The use of non-lethal methods would result in the translocation, dispersal, or exclusion of predators from areas where predation was occurring or could occur. The number of nest predators present in those areas would be reduced and those individual animals translocated, dispersed, or excluded would no longer be available for viewing in the area where predation was occurring or could occur.

Those methods would also be available for use by other entities in the absence of WS' direct involvement. The MDIFW could continue to allow take during the regulated harvest season and could continue to issue permits to allow for the take of those predators to alleviate nest predation. In addition, take could still occur through the issuance of depredation permits by the USFWS or under the depredation order for blackbirds. Therefore, the take of nest predators could continue despite WS' use of only non-lethal methods. If lethal methods were to continue by using trained, non-WS individuals, the number of nest predators taken annually could be similar under all the alternatives despite the use of non-lethal methods by WS.

Although nest predators would be translocated, dispersed, or excluded under this alternative, those species could still be viewed and enjoyed under this alternative if a reasonable effort were made to find those species outside the area where predation was occurring or could occur. The impacts to the aesthetic value of nest predators from the use of non-lethal methods by WS under this alternative would be low.

Issue 7 - Humaneness and Animal Welfare Concerns of Methods

A common issue often raised is concerns about the humaneness of methods available under the alternatives for resolving nest predation. The issues of method humaneness relating to the alternatives are discussed below.

WS continues to seek new methods and ways to improve current technology to improve the humaneness of methods. 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.

Alternative 1 – No Involvement by WS in Managing Predation Risks

Under this alternative, WS would not be involved with any aspect of alleviating nest predation in the State. Other entities could continue to use those methods legally available when permitted by the USFWS, the MDIFW, and other federal, State, and local regulations. Those methods would likely be considered inhumane by those persons who would consider methods proposed under any alternative as inhumane. The issue of humaneness would likely be directly linked to the methods legally available to the public since methods are often labeled as inhumane by segments of society no matter the entity employing those methods. A method considered inhumane, would still be perceived as inhumane regardless of the person or entity applying the method. However, even methods generally regarded as being a humane method could be employed in inhumane ways if that method was employed by those persons inexperienced in the use of those methods or if those persons 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. Therefore, those methods considered inhumane would continue to be available for use under this alternative. If those persons apply those methods considered humane as intended and in consideration of the humane use of those methods, then the issue of method humaneness would be similar across the alternatives. If persons employ humane methods in ways that are inhumane, the issue of method humaneness could be greater under this alternative if those persons were 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 would be difficult to determine and could just as likely be similar across the alternatives. Similar to the other alternatives, the lack of understanding of predator behavior or proper method use could lead to situations where methods were employed that could be perceived as inhumane.

Alternative 2 – Managing Nest Predation Risks by WS through Technical Assistance Only

The issues of humaneness of methods under this alternative would likely be similar to humaneness issues discussed under the proposed action. This similarity would be derived from WS' recommendation of methods that some consider inhumane. WS would not directly be involved with activities under this alternative. However, the recommendation of the use of methods could result in the requestor 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 species, which, if used appropriately, would minimize pain and suffering. However, the efficacy of methods employed by a cooperator would be based on the skill and knowledge of the requestor in resolving predation despite WS' demonstration. Therefore, a lack of understanding of the behavior of nest predators or improperly identifying the species responsible for predation along with inadequate knowledge and skill in using methodologies to resolve predation could lead to incidents with a greater probability of being perceived as inhumane. In those situations, the pain and suffering would likely be regarded as greater than discussed in the proposed action.

Those persons requesting assistance would be directly responsible for the use and placement of methods and if monitoring or checking of those methods does not occur in a timely manner, captured wildlife could experience suffering and if not address timely, could experience distress. The amount of time an animal was restrained under the proposed action would be shorter compared to a technical assistance alternative if those requestors implementing methods were not as diligent or timely in checking methods. Similar to Alternative 1, it is difficult to evaluate the behavior of individual people, especially when attempting to determine what those individual people may or may not do 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 likely 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 individual animals would likely be higher.

Alternative 3 - Continuing the Current Integrated Approach to Managing Nest Predation (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.*, limited habitat modification, modification of human behavior), nest destruction, exclusion devices, translocation, frightening devices, cage traps, foothold traps, and repellents.

As discussed previously, humaneness, in part, appears to be a person's perception of harm or pain inflicted on an animal. People may perceive the humaneness of an action differently. The challenge in coping with this issue is how to achieve the least amount of animal suffering.

Some individuals believe any use of lethal methods to resolve predation risks 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 predation 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 predation and threats associated with wildlife. The goal of WS is to use methods as humanely as possible to resolve requests for assistance. WS would continue to evaluate methods and activities to minimize the pain and suffering of methods addressed when attempting to resolve requests for assistance.

Some methods have been stereotyped as "*humane*" or "*inhumane*". However, many "*humane*" methods can be inhumane if not used appropriately. For instance, a live trap is generally considered by most members of the public as "*humane*". Yet, without proper care, live-captured wildlife in a cage trap can be treated inhumanely if not attended to appropriately. Therefore, the goal is to address requests for assistance using methods in the most humane way possible that minimizes the stress and pain to the animal. Overall, the use of resource management methods, harassment methods, and exclusion devices are regarded as humane when used appropriately. Although some concern arises from the use of live-capture methods, the stress of animals is likely temporary.

Although some issues of humaneness could occur from the use of cage traps, immobilizing drugs, and repellents, those methods, when used appropriately and by trained personnel, would not result in the inhumane treatment of wildlife. Concerns regarding the use of non-lethal methods would be 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 nest predators were to be live-captured by WS, those methods would be checked frequently to ensure those nest predators captured were addressed timely and to prevent injury. Although stress could occur from being restrained, timely attention to live-captured wildlife would alleviate suffering. Stress would likely be temporary. Euthanasia of live-captured target mammals by WS under Alternative 1 would occur pursuant to WS Directive 2.505.

Under the proposed action, lethal methods could also be employed to resolve requests for assistance to resolve or prevent nest predation. Lethal methods would include shooting, cable devices, DRC-1339, euthanasia after target species were live-captured, gas cartridges, and body-gripping traps. WS' use of euthanasia methods under the proposed action would follow those required by WS' directives (see WS Directive 2.505, WS Directive 2.430). WS' personnel that employ firearms to address nest predation 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 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). Although not well known for crows and gulls, 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 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 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 crows and gulls would only be available to WS' personnel for use.

The gas cartridge is registered as a fumigant by the EPA (Reg. No. 56228-21). Gas cartridges would be used in conjunction with denning operations in Maine to target red fox, striped skunks, and coyotes. When ignited, the cartridge burns in the den of an animal and produces large amounts of carbon monoxide, a colorless, odorless, and tasteless, poisonous gas. The combination of oxygen depletion and carbon monoxide exposure kills the animals in the den.

Although mesurol is labeled as a restricted use pesticide, and may be toxic to birds that ingest it, when used properly, this chemical method is designed to create taste aversion, and has been proven a useful tool to control egg predation in contrast to using lethal methods (Avery et al. 1995). The active ingredient in mesurol is methiocarb, which is a carbamate pesticide and acts as a cholinesterase inhibitor. Species that feed upon treated eggs may show signs of toxicity (*e.g.*, regurgitation, lethargy, temporary immobilization). Occasionally, birds may die after feeding upon treated eggs, but most birds exposed to treated eggs survive. Birds usually begin to vomit 10 to 15 minutes after eating methiocarb-treated bait, and often then lose motor coordination. They recover within an hour and soon learn to avoid the treated food (as cited in Avery 1984). The fact that this chemical is used as a non-lethal option would appeal to some people; although, some people may also consider causing temporary illness to be inhumane.

Avitrol® repels birds by causing them to become hyperactive when treated bait is ingested (see discussion in Appendix B). Their distress calls generally alarm the other birds in a flock and cause them to leave the site. Only a small number of birds need to be affected to cause alarm in the rest of the flock. The affected birds generally die. In most cases where Avitrol® is used, only a small percentage of the birds are affected and killed by the chemical with the rest being merely dispersed. In experiments to determine suffering, stress, or pain in affected animals, Rowsell et al. (1979) tested Avitrol® on pigeons and observed subjects for clinical, pathological, or neural changes indicative of pain or distress. Conclusions of the study were that the chemical met the criteria for a humane pesticide. Notwithstanding, some persons would view Avitrol® as inhumane treatment of the birds that are affected by it based on the birds' distress-like behavior and resulting death.

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 were used in situations where non-lethal methods were not practical or effective. Personnel from WS would be experienced and professional in their use of management methods. Consequently, management methods would be implemented in the most humane manner possible. Those methods discussed in Appendix B to alleviate nest predation in the State, except for DRC-1339 and mesurol could be used under any of the alternatives regardless of WS' direct involvement. Therefore, the issue of humaneness associated with methods would be similar across any of the alternatives since those same 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 were used by WS as humanely as possible are listed in Chapter 3.

WS has improved the selectivity and humaneness of management techniques through research and development. 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 were used in situations where non-lethal methods were not practical or effective.

Alternative 4 – Managing Nest Predation Using Non-lethal Methods Only

Under this alternative, only non-lethal methods would be used by WS, which would generally be regarded as humane. Non-lethal methods would include resource management methods (*e.g.*, minor habitat modification, modification of human behavior), translocation, exclusion devices, frightening devices, live traps, foothold traps, cable restraints, and repellents.

Although some issues of humaneness could occur from the use of cage traps, foothold, cable restraints, and repellents, those methods, when used appropriately and by trained personnel, would not result in the inhumane treatment of wildlife. Concerns from the use of those non-lethal methods would be 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.

The applicability of cage traps, foothold traps, cable restraints, translocation, repellents, minor habitat modifications, and exclusion for resolving nest predation would be limited under this alternative. Overall, the use of resource management methods, harassment methods, live-capture methods, and exclusion devices would be regarded as humane when used appropriately. Although some concern arises from the use of live-capture methods, the stress of animals would likely be temporary and would cease once the animal was released.

Issue 8 - Effects of Nest Predator Management Activities on the Regulated Harvest of Those Species

Another common concern is the potential effects of activities on the ability to harvest target species during the regulated hunting and trapping season in the State. Many of the species addressed in the assessment have a socio-cultural value as a harvestable game species. Those species are sought by hunters and trappers in the State. Hunters and trappers often pass the tradition on to family members or those hunters and trappers are members of clubs that provide social interaction with other sportsmen.

Methods intended to disperse or remove target species from an area where predation was occurring could reduce the opportunities to harvest those species during the regulated harvest seasons. Those species addressed in this EA that are known nest predators that can also be harvested during annual hunting and/or trapping seasons include red fox, gray fox, coyotes, raccoons, opossum, skunks, mink, weasels, and crows.

Alternative 1 – No Involvement by WS in Managing Predation Risks

WS would have no impact on the ability to harvest those species addressed in this assessment under this alternative. WS would not be involved with any aspect of alleviating nest predation risks. The USFWS and the MDIFW would continue to regulate populations through adjustments of the allowed take during the regulated harvest seasons and the continued use of the depredation order for crows.

Alternative 2 – Managing Nest Predation Risks by WS through Technical Assistance Only

WS would have no impact on the regulated harvest of nest predators since WS would not lethally remove those species under this alternative. However, resource/property owners may remove nest predators under permits issued by the MDIFW, under depredation permits issued by the USFWS, and for crows, under the blackbird depredation order established by the USFWS resulting in the lethal take of harvestable species at levels similar to the proposed action and the other alternatives. The recommendation of non-lethal methods could disperse or exclude nest predators from areas under this alternative, which could limit the ability of those persons interested to harvest those species in the area

those methods were employed. However, the populations of those species would be unaffected by WS under this alternative.

Alternative 3 - Continuing the Current Integrated Approach to Managing Nest Predation (Proposed Action/No Action)

The magnitude of take addressed under the proposed action would be low when compared to the mortality of those species from all known sources. When WS' proposed take of nest predators was included as part of the known mortality of those species and compared to the estimated populations, the impact on those species' populations was below the level of removal required to lower population levels. The MDIFW would determine the number of mammalian nest predators taken annually by WS through the issuance of permits, when required. In addition, those nest predators removed by WS would be those nest predators that could be removed by other entities when permitted by the MDIFW. The USFWS and the MDIFW would continue to maintain authority of the harvest of crows during annual hunting seasons in the State, including the allowable annual take.

Activities conducted by WS would occur after consultation and approval by the MDIFW and/or the USFWS. With oversight by the MDIFW and/or the USFWS, the allowed number of nest predators taken by WS would not limit the ability of those persons interested to harvest those species during the regulated seasons. All take by WS would be reported to the MDIFW and the USFWS annually to ensure take by WS is incorporated into population management objectives established for those species.

Alternative 4 – Managing Nest Predation Using Non-lethal Methods Only

Similar to the Alternative 1 and Alternative 2, WS would have no impact on regulated hunting or trapping since WS would not lethally remove nest predators under this alternative. However, resource/property owners may remove nest predators when permitted resulting in impacts similar to the proposed action and the other alternatives. The use and recommendation of non-lethal methods could disperse or exclude nest predators from areas under this alternative, which could limit the ability of those persons interested to harvest those species in the area. However, the populations of those species would be unaffected by WS under this alternative.

Issue 9 - Effects on Recreation in Areas Where Nest Predation Management Activities Occur

Several forms of recreation may be affected by activities; most notably, beach going, wildlife viewing, hunting, trapping, and fishing. These recreational activities currently occur in the areas where seabirds and shorebirds nest; however, there are varying degrees of these activities relative to location and time of year.

Alternative 1 – No Involvement by WS in Managing Predation Risks

Under this alternative, WS would not conduct activities in the State associated with nest predation. WS would have no direct involvement with any aspect of addressing nest predation and would provide no technical assistance. Therefore, WS would not have any effect on recreational activities. However, activities could be conducted by other entities, which may prevent access.

Alternative 2 – Managing Nest Predation Risks by WS through Technical Assistance Only

Recreation in the State would not be directly impacted by WS from a program implementing technical assistance only. However, other entities could implement methods based on WS' recommendations. Under a technical assistance only alternative, WS would recommend and demonstrate the use of methods

for other entities to employ. Conflicts with recreation would be low, and may resemble those conflicts detailed in Alternative 3.

Alternative 3 - Continuing the Current Integrated Approach to Managing Nest Predation (Proposed Action/No Action)

Under this alternative, activities to alleviate nest predation would have only marginal effects on recreation. WS uses practical and efficient techniques that do not typically conflict with other land uses. WS would only employ methods in accordance with landowner permission. Most federally owned lands would be closed to human access during the nesting season to prevent disturbance to the nesting birds, although bird monitors and WS' personnel would be allowed to work in those areas under this alternative. Because those areas would be closed to recreation despite WS' involvement, no conflicts associated specifically with WS' activities would be expected on federal land.

During previous projects to alleviate nest predation, no measurable disruption to recreation was observed by WS. In general, public use of nesting beaches remains high throughout the nesting season. WS would not place any restrictions on beach access in areas where activities would be conducted.

WS could also conduct activities on private and state-owned lands. In those cases, the landowner objectives would be discussed before any activities were conducted. Furthermore, methods would be understood by the landowners and potential conflicts with recreation would be discussed. In most cases, WS would not employ methods that would cause conflicts with recreation. In some cases, such as with the placement of traps, signs would be used to notify the public as required by WS Directive 2.450.

Beach Management Agreements are formal documents that detail the types of activities that would be allowed on beaches where piping plovers and least terns nest. The MDIFW and the USFWS have existing Beach Management Agreements with several municipalities, and in most cases, these agreements limit certain forms of recreation. One form of recreation that commonly occurs on beaches is dog walking. Most Beach Management Agreements either prohibit dogs on beaches during the nesting season, or have specific limitations on this activity such as season, time of day, or specify that dogs must be leashed to prevent disturbance to the birds. Activities would not likely affect dog walking beyond the restrictions specified in the Beach Management Agreements. Between FY 2007 and FY 2011, WS incidentally captured one dog in a foothold trap, although this dog had wandered off a road onto closed, federal property. No dogs have been incidentally captured on beaches during the same period. Finally, dogs would not be allowed on most offshore nesting islands where roseate terns nest, so WS would not affect dog-walking recreation in those locations.

Beach going activity (*e.g.*, sunbathing, swimming, walking, jogging, and lounging) is the most likely form of recreation that could be affected by WS' activities. The limits that are placed on these activities would be established regardless of WS' involvement. For example, access could be prohibited by both state and federal law on coastal islands where roseate terns nest. For piping plover and least tern nesting areas, symbolic fencing (*e.g.*, stakes, posts, twine, and/or cable) is placed each year prior to the nesting season, and signs are posted that indicate access to those areas is prohibited. No incremental restrictions to beach access and recreation would be anticipated due to WS' involvement under this alternative that would not already occur or could occur.

No effect on wildlife viewing, hunting, or fishing would be expected as a results of WS' involvement under this alternative. As previously stated, the level of access to certain areas is determined by land managers regardless of WS' involvement. Wildlife viewing would likely be affected in a minor way. Because the objectives of reducing predation risks would be to remove or disperse predators from nesting areas, this would mean that less individuals of the target species would be available to be observed. It

would be expected that only resident and transient predators would be removed or dispersed. Those individuals that occupy adjacent home ranges would not be affected and would still be available for viewing opportunities. Fishing is a form of recreation that does occur to a degree at or near nesting areas. As previously stated, trespass is prohibited in some areas, and fishing would not be conducted in those areas. Outside of the nesting areas, it would be expected that fishing opportunities would not be significantly affected by activities to alleviate predation risks.

Nest predator management activities would occur primarily from March through July and would have little impact on recreation activities that take place during the summer months. However, during the nesting season, some local areas would remain closed to public access to limit disturbance of nesting birds or survival of fledglings; thereby, affecting those persons that would potentially use those areas for recreational activities. Swimming, sunbathing, and picnics would probably not be affected by nest predator management activities because predator management activities generally occur in times and places where these types of recreation do not occur.

Dog walking is a form of recreation that is commonly conducted on beaches. The state of Maine has an existing law (7 MRSA §3911) that prohibits dogs at large. Dogs are often walked either on-leash or off-leash, although some local areas have restrictions or ordinances in place that limit certain dog-walking activity. It is unlikely that even dogs being walked off-leash would be adversely affected by activities, because traps would typically be set in places where pets do not venture. From FY 2007 through FY 2011, no dogs were incidentally captured during prior activities. In addition, WS is not aware of any instances where opportunities to walk dogs were limited by activities conducted previously.

Alternative 4 – Managing Nest Predation Using Non-lethal Methods Only

The effects to recreation under a non-lethal only approach would be similar to the effects identified under alternative 3 with the exception that lethal methods would not be used. Because beaches are often public places with other people and activities, the disturbance impact would be expected to be low. Under this alternative WS would continue to capture animals with restraining devices, except they would be translocated. Translocated animals would be available for wildlife viewing, and fur harvest. However, similar to Alternative 3, WS' involvement would not result in additional closures or restrictions that would not have already occurred in the absence of WS' involvement.

4.2 CUMULATIVE IMPACTS OF THE PROPOSED ACTION BY ISSUE

Cumulative impacts, as defined by the 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 2, Alternative 3, and Alternative 4, WS could address predation risks associated with nest predators by providing technical assistance only (Alternative 2) or by providing technical assistance and direct operational assistance (Alternative 3 or Alternative 4) in the State. WS would be the primary agency conducting direct operational activities in the State under Alternative 3 and Alternative 4. However, other federal, State, and private entities could also be conducting activities to alleviate nest predation in the State. In prior years, federal and private entities have conducted, and continue to conduct activities to protect roseate terns. Prior to 2007, state and private entities conducted activities to protect piping plovers and least terns.

WS does not normally conduct activities concurrently with such agencies or other entities in the same

area, but may conduct activities at adjacent sites within the same period. The potential cumulative impacts analyzed below could occur because of WS' 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 MDIFW, activities of each agency and the take of nest predators would be available. Activities conducted by WS in the State would be monitored under Alternative 2, Alternative 3, and Alternative 4 to evaluate and analyze activities to ensure they remain within the scope of analysis of this EA.

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.

Issue 1 - Effects of Activities on Target Wildlife Populations

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

- Natural mortality of wildlife
- Human-induced mortality of wildlife through private damage management activities
- Human-induced mortality from illegal take, vehicle strikes, and aircraft strikes
- Annual harvest of wildlife during regulated hunting and trapping seasons
- 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 wildlife populations. In many circumstances, requests for assistance arise when some or all of those elements have contrived to elevate target species populations or place target species at a juncture where predation occurs at undesirable levels. The actions taken to minimize or eliminate nest predation would be 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 predation risks, including other affected elements and the dynamics of the species involved; to determine appropriate strategies to minimize effects on environmental elements; applies management actions; and subsequently monitors and adjusts/ceases 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 effects on target species.

With management authority over wildlife populations, the USFWS and the MDIFW can adjust take levels, including the take of WS, to ensure population objectives for those species are achieved. Consultation and reporting of take by WS would ensure the USFWS and the MDIFW considers any activities conducted by WS.

WS' take of nest predators in Maine from FY 2007 through FY 2011 was of a low magnitude when compared to the total known take and estimated population levels. The USFWS and the MDIFW considers all known take when determining population objectives for the populations of those species and could adjust the number of nest predators that can be taken to achieve the population objectives. Any take by WS would occur at the discretion of the USFWS and the MDIFW. Any population declines or increases that are associated activities to alleviate nest predation would be the collective objective for

wildlife populations established by the USFWS and the MDIFW through the regulation of take. Therefore, the cumulative take of nest predators annually or over time by WS would occur at the desire of the USFWS and the MDIFW as part of management objectives for those species in the State.

No cumulative adverse effects would be expected from WS' actions based on the following considerations:

Historical outcomes of WS' activities on wildlife

Activities would be conducted by WS only at the request of a cooperator to reduce predation that is occurring or prevent predation from occurring and only after methods to be used were agreed upon by all parties involved. WS monitors activities to ensure any potential impacts would be identified and addressed. WS would work closely with the MDIFW and the USFWS to ensure WS' activities would not adversely affect wildlife populations. Consultation with the MDIFW and the USFWS also ensures that WS' activities would be considered as part of management goals established by those agencies. From FY 2007 through FY 2011, WS' activities to manage nest predation in Maine have not reached a magnitude that would cause adverse impacts to wildlife populations locally or statewide.

SOPs built into the WS program

SOPs are designed to reduce the potential negative effects of WS' actions on wildlife, and are tailored to respond to changes in wildlife populations that 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 would be insured through monitoring, in accordance with the WS' Decision Model (Slate et al. 1992).

Issue 2 - Effects of Activities on the Populations of Non-target Wildlife

Potential effects on non-target species from conducting activities would arise from the use of non-lethal and lethal methods to alleviate or prevent predation. The use of non-lethal methods during activities to reduce or prevent predation 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 to ensure effectiveness. Therefore, the use of exclusionary devices would be somewhat limited to small 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. The use of visual and auditory harassment and dispersion methods are generally temporary with non-target species returning after the cessation of those activities. Dispersal and harassment do not involve the take (killing) of non-target species and similar to exclusionary methods are not used to the extent or at a constant level that would prevent non-targets from accessing critical resources that would threaten survival of a population.

The use of lethal methods or those methods used to live-capture target species followed by euthanasia also have the potential to affect non-target wildlife through the lethal take or non-lethal capture of non-target species. Capture methods used are often methods that are set to confine or restrain target wildlife after being triggered by the applicator. 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 are employed to confine or restrain wildlife that are subsequently euthanized using humane methods since translocation is currently not allowed by the MDIFW without a permit. With all live-capture devices, non-target wildlife captured could be released on site if determined to be able to survive following release. SOPs are intended to ensure take of non-target wildlife would be minimal during the use of methods to capture target wildlife.

The use of firearms and euthanasia methods would essentially be selective for target species since identification of an individual would be made prior to the application of the method. Therefore, the use of those methods would not affect non-target species.

Chemical methods available for use under the proposed action are immobilizing drugs, euthanasia chemicals, mesurol, DRC-1339, gas cartridges, and Avitrol®, which are described in Appendix B. Avitrol®, DRC-1339, and mesurol would be employed using baits that are highly attractive to target species and 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 chemical methods 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 to WS Directives. 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 those chemical methods would be followed to minimize non-target hazards. As required by the label for DRC-1339, Avitrol®, and mesurol, an acclimation period occurs and sites would be monitored for non-target use as outlined in the label. If non-target wildlife were observed feeding on pre-bait, those sites would be abandoned. Before the use of gas cartridges, burrows entrances would be observed for signs of target and on-target use (*e.g.*, scat, tracks). If signs of non-target use were present, those burrows would not be treated. Treating only burrows that show active signs of the target species greatly reduces the likelihood of non-targets being present inside the burrows.

The methods described in Appendix B all have a high level of selectivity and could be employed using SOPs to ensure minimal impacts to non-targets species. Although non-targets have been lethally taken by WS during activities to alleviate nest predation from FY 2007 through FY 2011, the magnitude of take has been low. Based on the methods available to resolve nest predation, WS does not anticipate the number of non-targets taken to reach a magnitude where declines in those species' populations would occur. Therefore, take under the proposed action of non-targets would not cumulatively affect non-target species.

Issue 3 – Effects of Activities on Threatened and Endangered Species

Those entities requesting WS' assistance do so to reduce predation risks, which could benefit plovers and terns by increasing nesting success rates. A Section 7 consultation was conducted with the USFWS Ecological Services field office in Maine regarding nest predator activities designed to enhance the nesting success of piping plovers and roseate terns in Maine. The USFWS concurred with WS' determination that activities related to managing nest predation risks would not adversely affect piping plovers (L. Nordstrom, USFWS, pers. comm. 2009). A separate Section 7 consultation was conducted

relative to the effects of the nest predator program on roseate terns in Maine. The USFWS again concurred with WS' determination that activities related to reducing predation risks would not adversely affect roseate terns (L. Zicari, USFWS, pers. comm. 2012). Based on the use patterns of methods and coordination with the USFWS and the MDIFW, WS has determined activities proposed would have no effect on other T&E species listed in the area where activities could be conducted.

In addition, WS prepared standard operating procedures to safeguard state T&E species (see Appendix I). WS has received concurrence from the MDIFW on the standard operating procedures (G. Matula, MDIFW pers. comm. 2010).

Issue 4 - Effectiveness of Methods and Strategies for Alleviating Nest Predation Risks

As discussed in Chapter 2, the effectiveness of activities could be defined in terms of losses or risks potentially reduced or prevented which is based on how accurately people diagnosis the problem, the species responsible for the predation or posing a predation threat, and how actions were implemented to correct or mitigate risks or predation. The most effective approach to resolving nest predation would be to use an adaptive integrated approach, which may call for the use of several management methods simultaneously, or sequentially.

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 would be to enhance the nesting success of ground nesting waterbirds by reducing predation risks, as requested. WS recognizes that localized population reduction could be short-term and that new individuals may immigrate, be released at the site, or be born to animals remaining at the site (Courchamp et al. 2003). The ability of an animal population to sustain a certain level of removal and to eventually return to pre-management levels, however, does not mean individual management actions are unsuccessful, but that periodic management may be necessary.

Correlated with the effectiveness of methods at reducing or alleviating nest predation are the costs associated with applying methods to reduce predation or threats. If methods were ineffective at reducing or alleviating nest predation or if methods require re-application after initially being successful, the costs associated with applying those methods would increase. An analysis of cost-effectiveness in many situations is difficult or impossible to determine because the value of benefits may not be readily calculable and personal perspectives differ about predation.

As part of an integrated approach to managing nest predation, WS would have the ability to adapt methods to effectively reduce or prevent predation 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 would be to reduce nest predation on colonial waterbirds or to prevent nest predation from occurring using an integrated approach. Therefore, under the proposed action, WS would employ methods adaptively to achieve that objective.

The CEQ does not require a formal, monetized cost-benefit analysis to comply with the NEPA (40 CFR 1508.14) and consideration of that issue is not essential to making a reasoned choice among the alternatives being considered. In a ruling for Southern Utah Wilderness Alliance, et al. vs. Hugh Thompson, Forest Supervisor for the Dixie NF, et al., the court denied plaintiffs' motion for preliminary injunction. In part, the court found that it was only necessary to show that damage from wildlife is threatened, to establish a need for wildlife damage management (U.S. District Court of Utah 1993).

As stated in the EA, 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 in which all methods used to address nest predation were agreed upon prior to conducting activities. Methods employed to manage nest predation, whether non-lethal or lethal, would often be temporary with the duration dependent on many factors discussed in the EA. WS would employ only those methods agreed upon by the requestor after available methods were discussed.

Concern is often raised that nest predators only return to an area where predation was occurring if lethal methods were 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 would also be temporary, which could result in nest predators returning to an area where predation was occurring once those methods are no longer used. Nest predators would return if suitable habitat continues to exist at the location where predation was occurring and densities were sufficient to occupy all available habitats. Therefore, any reduction or prevention of predation from the use of methods addressed in the EA would be temporary if habitat conditions continue to exist. Any method that disperses or removes nest predators from areas would only be temporary if habitat continues to exist. Dispersing nest predators using pyrotechnics, repellents, or any other non-lethal method addressed in the EA often requires repeated application to discourage those species from an area, which increases costs, moves those nest predators to other areas where they could cause damage, and would be temporary if habitat conditions remain unchanged. Dispersing and the translocating of nest predators could be viewed as moving problem wildlife from one area to another, which would require addressing damage caused by those wildlife species at another location. 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 nest predation that is agreed upon by the cooperator. WS' legislative authority to manage wildlife damage was also addressed in the EA.

Issue 5 - Effects of Management Methods on Human Health and Safety

Non-Chemical Methods

Non-chemical methods would be used by WS within a limited period, methods would not be residual, and methods would not possess properties capable of inducing cumulative adverse effects on human health and safety. All non-chemical methods would be used after careful consideration of the safety of those persons employing methods and to the public. All capture methods would be employed where human activity was minimal to ensure the safety of the public. All methods would be agreed upon by the requesting entities, which would be made aware of the safety issues associated with 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 predation, though hazards do exist, would be employed to ensure the safety of employees and the public.

WS has received no reports or documented any adverse effects to human safety from WS' activities conducted from FY 2007 through FY 2011. Personnel employing non-chemical methods would continue to be trained in the proficient use of those methods available to ensure the 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.

Chemical Methods

Chemical methods available for use under the proposed action would be gas cartridges, mesurol, DRC-1339, Avitrol®, immobilizing drugs, and euthanasia drugs. Risks to the public from the use of those

chemical methods could occur through either direct exposure to the chemical or exposure to the chemical from target species that have been lethally taken by those methods. As was discussed previously, mesurol, DRC-1339, and Avitrol® require ingestion of bait by target species. In the case of immobilizing drugs and euthanasia chemicals, those chemical methods would be injected directly into animals. Therefore, risks to human safety would not occur from handling those animals. Some risks could occur from the harvest and consumption of target species if chemical methods were employed during a period when hunting and/or trapping seasons could occur simultaneously or where chemicals could still be present in the system of target species at the start of the harvest season. In those situations, WS would not employ chemical methods or would properly mark an animal.

WS would follow all label requirements associated with the use of those chemical methods. WS' employees would follow approved procedures outlined in the WS' Field Manual for the Operational Use of Immobilizing and Euthanizing Drugs (Johnson et al. 2001) when employing immobilizing drugs and euthanasia chemicals. The use of immobilizing chemicals and euthanasia chemicals would essentially be selective for target species since identification of an individual is made prior to the application of the method. Therefore, cumulative adverse affects to human safety from the use of immobilizing drugs and euthanasia chemicals would not occur.

DRC-1339 may be used by WS to manage nest predation with crows and gulls in Maine. DRC-1339 has been evaluated for possible residual effects that 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 only in those areas where non-targets are not present or would not be exposed to treated baits. Baits treated with DRC-1339 would be placed in gull nests, on platforms, or other hard surfaces where they seldom contact with soil, surface water, and/or ground water. All uneaten bait is recovered and disposed of according to EPA label requirements.

The half-life of DRC-1339 in biologically active soil was estimated at 25 hours with the identified metabolites having a low toxicity (EPA 1995). DRC-1339 is also highly soluble in water, does not hydrolyze, and photodegrades quickly in water with a half-life estimated at 6.3 hours in summer, 9.2 hours in spring sunlight, and 41 hours during winter (EPA 1995). DRC-1339 binds tightly with soil and has low mobility (EPA 1995). Additionally, the relatively small quantity of DRC-1339 that could potentially be used in crow or gull nest predation programs in Maine, 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. From FY 2007 through FY 2011, WS has used 615.90 grams of DRC-1339 during all damage management activities associated with birds. Previous uses of DRC-1339 by WS occurred primarily to alleviate pigeon and starling damage. The use of DRC-1339 under the proposed action and in other damage management activities is not expected to increase to a level that adverse effects would occur from the cumulative use of the chemical. Based on potential use patterns, the chemical and physical characteristics of DRC-1339, and factors related to the environmental fate, no cumulative impacts are expected from the lethal chemical components used or recommended by the WS program in Maine.

Avitrol® is acutely toxic to birds and fish but does not bioaccumulate; however, it could potentially contaminate water if misused. Because of this, the label does not allow for application directly to water, or to areas where surface water is present or to intertidal areas below the mean high water mark. The EPA determined during the reregistration process for Avitrol® that environmental exposure of Avitrol® was expected to be minimal and no drinking water exposure was expected (EPA 2007).

Gas cartridges would be placed inside dens, ignited, and the entrance of the den would be sealed with dirt. Gas cartridges contain sodium nitrate, which when ignited produces carbon monoxide gas. Sodium nitrate is a naturally occurring substance (EPA 1991). When used as a fumigant, the carbon monoxide

gas produced from igniting the sodium nitrate dissipates into the atmosphere where it would be diluted into the air (EPA 1991). Some dissipation of carbon monoxide gas into the soil also likely occurs. Given the use patterns of gas cartridges, the likelihood of their use resulting in cumulative adverse effects on human health 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 to WS' directives. The amount of chemicals used or stored by WS would be minimal to ensure human safety.

No adverse effects have been report to or identified by WS from the use of chemical methods during previous activities to alleviate predation risks conducted by WS from FY 2007 through FY 2011. When chemical methods were applied as intended and when safety guidelines were followed, no adverse effects to human safety would be expected. The primary risk of exposure to chemical methods occurs to handlers and applicators. WS' personnel who use and apply chemical methods would be trained according to federal, State, and local laws and regulations, including WS' directives. Based on this information, the use of chemical methods as part of the proposed action by WS would not have cumulative impacts on human safety.

Issue 6 - Effects on the Socio-cultural Elements of the Human Environment

The activities of WS would result in the removal of predators from those areas where nest predation was occurring. Therefore, the aesthetic value of those wildlife species in those areas where activities were being conducted would be reduced. However, for some people, the aesthetic value of a more natural environment would be gained by reducing predator densities, including the return of native wildlife species that may be suppressed or displaced by high predator densities.

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 nest predator 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.

Wildlife population objectives are established and enforced by the USFWS and the MDIFW through regulating the take of wildlife during the statewide hunting and trapping seasons, through depredation orders, and through the issuance of permits after consideration of other known mortality factors. Therefore, WS has no direct impact on the status of the nest predator populations since all take by WS occurs at the discretion of the USFWS and the MDIFW and only at levels authorized. Since those persons seeking assistance could remove nest predators from areas where predation was occurring or could occur through the established depredation order for crows or through permits issued by the MDIFW and/or the USFWS, WS' involvement would have no effect of the aesthetic value of those species in the area where predation or the threat of predation was occurring. When a permit was issued by the MDIFW and/or the USFWS to a property owner and/or manager, the removal of those nest predators under that permit would likely occur whether WS was involved with taking those nest predators or not. Under the established depredation order, the take of crows can occur without a need for a depredation permit when certain conditions are met. Take of those wildlife species address in this EA can also occur during the regulated hunting and trapping seasons in the State.

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 and a permit has

been issued by the MDIFW and/or the USFWS who is responsible for regulating a resident wildlife species.

Issue 7 - 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 would be addressed in a timely manner to minimize distress of the animal. All euthanasia methods used for live-captured wildlife 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 wildlife 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 in Maine, the cumulative impacts on the issue of method humaneness are minimal. All methods would be evaluated annually to ensure measures and SOPs are adequate to ensure those methods continue to be used to minimize suffering and that wildlife captured are addressed in a timely manner to minimize distress.

Issue 8 - Effects of Nest Predator Management Activities on the Regulated Harvest of Those Species

As discussed previously in this EA, the magnitude of WS' take of nest predators from FY 2007 through FY 2011 was low when compared to the total take of those species and when compared to the estimated statewide population. Since all take of nest predators is regulated by the USFWS and/or the MDIFW, the take of nest predators by WS that would occur annually and cumulatively would occur pursuant to population objectives established by the USFWS and/or the MDIFW. WS' take of nest predators annually would be a minor component to the known take that occurs annually. With oversight of take, the USFWS and the MDIFW maintains the ability to regulate take by WS to meet management objectives for those species in the State. Therefore, the cumulative take of nest predators would be considered as part of the USFWS and MDIFW objectives for those species' populations in the State. Any changes in the population of those species in the State would occur at the direction and the discretion of the USFWS and/or the MDIFW.

Issue 9 - Effects on Recreation in Areas Where Nest Predation Management Activities Occur

The beach environment in southern and coastal Maine has numerous activities that may be incompatible; however, it is not likely that alleviating predation risks in nesting areas would cause adverse effects to those recreational activities. WS attempts to minimize all conflicts with other beach users. In most cases, WS methods would be utilized in areas where recreationists are not allowed to access. In cases where activities could be conducted in public areas, methods would not cause limitations to recreational beyond those imposed by the property owner or manager. WS often is able to avoid conflict by timing the activities when other users are not present. The majority of methods would be used in seasons when recreation is more limited, which further acts to avoid conflicts. Any conflicts with recreational pursuits would not be expected to adversely affect environmental quality in any way.

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APPENDIX A
LITERATURE CITED

Aguilera, E., R. L. Knight, and J. L. Cummings. 1991. An evaluation of two hazing methods for urban Canada geese. Wildl. Soc. Bull. 19:32-35.

Allen, D.L. 1938. Ecological studies on the vertebrate fauna of a 500-acre farm in Kalamazoo County, Michigan. Ecol. Monogr. 8:347-436.

Allen, S. H., and A. B. Sargeant. 1993. Dispersal patterns of red foxes relative to population density. J. Wildl. Manage. 57:526-533.

Angehrn, P.A.M., H. Blokpoel, and P. Courtney. 1979. A review of the status of the great black-backed gull in the Great Lakes area. Ontario Field Biologist 33:27-33.

Apostolou, A. 1969. Comparative toxicology of the avicides 3-chloro-*p*-toluidine and 2-chloro-4-acetotoluidide in birds and mammals. PhD. Dissertation, University of California, Davis, California.

Arhart, D. K. 1972. Some factors that influence the response of European starlings to aversive visual stimuli. M.S. Thesis. Oregon State University, Corvallis.

Association of Fish and Wildlife Agencies. 2006. Best management practices for trapping in the United States. Washington, D.C.

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, E. A. Tillman, K. O. Pares, and J. E. Hatcher. 2002. Dispersing vulture roosts on communication towers. J. of Raptor Research 36:44-49.

Avery, M. L., M. A. Pavelka, D. L. Bergman, D. G. Decker, C. E. Knittle, and G. M. Linz. 1995. Aversive Conditioning to Reduce Raven Predation on California Condor Eggs. Colonial Waterbirds. 18:131-138.

Avery, M. L. 1984. Relative Importance of Taste Aversion in Reducing Bird Damage to Crops with Methiocarb, a Chemical Repellant. Agriculture, Ecosystems, and the Environment 11:299-308.

Avery, M.L., E.A. Tillman, and J.S. Humphrey. 2008. Effigies for dispersing urban crow roosts. Pp. 84-87 *in* R.M. Timm and M.B. Madon, eds. Proc. 23rd Vertebr. Pest Conf., University of California-Davis.

AVMA. 1987. Journal of the American Veterinary Medical Association. Panel Report on the Colloquim on Recognition and Alleviation of Animal Pain an Distress. 191:1186-1189.

Bailey, E. P. 1993. Introduction of foxes to Alaska islands – history, effects on avifauna, and eradication. Resourc. Publ. 193, U. S . Fish and Wildlife Serv. Washington, DC 53 pp.

Barber, C., A. Nowak, K. Tulk, and L. Thomas. 2010. Predator exclosures enhance reproductive success but increase adult mortality of piping plovers (*Charadrius melodus*). Avian Conservation and Ecology 5:6.

Bateson, P. 1991. Assessment of pain in animals. Anim. Behav. 42:827-839.

Beaver, B. V., W. Reed, S. Leary, B. McKiernan, F. Bain, R. Schultz, B. T. Bennett, P. Pascoe, E. Shull, L. C. Cork, R. Francis-Floyd, K. D. Amass, R. Johnson, R. Schmidt, W. Underwood, G. W. Thornton, B. Kohn. 2001. 2000 Report of the AVMA Panel on Euthanasia. JAVMA 218:669-696.

Becker, P. H. 1995. Effects of coloniality on gull predation on common tern (*Sterna hirundo*) chicks. Colonial Waterbirds 18:11-22.

Bekoff, M. 1982. Coyote. Pages 447–459 in J. A. Chapman and G. A. Feldhamer, Eds., Wild mammals of North America: biology, management, and economics. Johns Hopkins Univ. Press, Baltimore, Maryland. 1147 pp.

Benjamini, L. 1980. Bait Crops and Mesurol Sprays to Reduce Bird Damage to Sprouting Sugar Beets. Phytoparasitica. 8:151-161.

Bent, A.C. 1961. Life Histories of North American Birds of Prey: Hawks, Falcons, Caracaras, and Owls. Dover Publications, Inc. New York, NY. 482 pp.

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., 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.

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., G. E.Bernhardt, R. A. Dolbeer. 2002. Lasers as nonlethal avian repellents. J. Wildl. Manage. 66:250-258.

Blanton, E.M, B.U. Constantin, and G.L. Williams. 1992. Efficacy and methodology of urban pigeon control with DRC-1339. Proc. Eastern Wildlife Control Conference 5:58-62.

Blodget, B., and L. Henze. 1992. Use of DCR-1339 to eliminate gulls and re-establish a tern nesting colony in Buzzards Bay Massachusetts. Proceedings from the Fifth Eastern Wildlife Damage Control Conference: 212-215.

Blokpoel, H. and W.C. Scharf. 1991. The ring-billed gull in the Great Lakes of North America. Acta Congress of International Ornithology 20:2372-2377.

Blokpoel, H., and G.D. Tessier. 1986. The ring-billed gull in Ontario: a review of a new problem species. Occasional Paper Number 57. Canadian Wildlife Service. Ottawa, Ontario. 34 pp.

Blokpoel, H., and G.D. Tessier. 1992. Control of ring-billed gulls and herring gulls nesting at urban and industrial sites in Ontario, 1987-1990. Proceedings of the Eastern Wildlife Damage Conference 5: 51-57.

Boggess, E. K. 1994*a*. Raccoons. Pp C101-C107 *in* S. E. Hygnstrom, R. M. Timm and G. E. Larson, eds. Prevention and control of wildlife damage. University of Nebraska-Lincoln, Lincoln, Nebraska.

Boggess, E. K. 1994*b*. Mink. Pp C89-C92 *in* S. E. Hygnstrom, R. M. Timm and G. E. Larson, eds. Prevention and control of wildlife damage. University of Nebraska-Lincoln, Lincoln, Nebraska.

Bomford, M. 1990. Ineffectiveness of a sonic device for deterring European starlings. Wildlife Society Bulletin 18:151-156.

Bomford, M. and P.H. O'Brien. 1990. Sonic deterrents in animal damage control: a review of device tests and effectiveness. Wildlife Society Bulletin 18**:**411–422.

Booth, T.W. 1994. Bird dispersal techniques. Pp E-19-E-23 *in* S.E. Hygnstrom, R. M. Timm, and G. E. Larson, eds. Prevention and control of wildlife damage. Cooperative Extension Service. University of Nebraska, Lincoln, Nebraska.

Boyd, F.L., and D.I. Hall. 1987. Use of DRC-1339 to control crows in three roosts in Kentucky and Arkansas. Third Eastern Wildlife Damage Control Conference 3:3-7.

Brawn, J. D., and S. K. Robinson. 1996. Source-sink population dynamics may complicate interpretation of long-term census data. Ecology 77:3-12.

Breeding Bird Atlas Explorer (online resource). 2010. U.S. Geological Survey Patuxent Wildlife Research Center & National Biological Information Infrastructure. Accessed on December 3, 2010. http://www.pwrc.usgs.gov/bba. Data extracted from: Adamus, Paul R. 1987. Atlas of Breeding Birds in Maine, 1978-1983. Augusta, ME: Maine Department of Inland Fisheries and Wildlife. 366 pp.

Bruce, R.D. 1985. An Up-and-Down procedure for acute toxicity testing. Fundamentals of Applied Toxicology 5:151-157.

Bruce, R.D. 1987. A confirmatory study of the up-and-down method for acute oral toxicity testing. Fundamentals of Applied Toxicology 8:97-100.

Brundige, G. C. 1993. Predation ecology of the eastern coyote, *Canis latrans* var., in the Adirondacks, New York. Ph.D. Dissertation, State University of New York, Syracuse.

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.

Bouwer, H. 1989. The Bouwer and Rice slug test--an update. Ground Water 27:304-309.

Bull, J. 1974. The birds of New York State. Doubleday/Natural History Press. Garden City, New York. 392 pp.

Burt, W. H., and R. P. Grossenheider. 1952. A field guide to the mammals. Houghton Mifflin Company, Boston, MA. 200 pp.

Burt, W. H., and R. P. Grossenheider. 1976. A field guide to the mammals. Houghton Mifflin College, Boston, Massachusetts. 289 pp.

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.

Camenzind, F.J. 1978. Behavioral ecology of coyotes on the National Elk Refuge, Jackson Wyoming. Pp 267-294 *in* M. Bekoff, ed. Coyotes: biology, behavior and management. Academic Press, New York, New York.

Camuso, J., B. Currier, K. Frens, J. Jones, K. O'Brien, and B. Simpson. 2011. 2010 Piping Plover and Least Tern Project Report for Maine. Maine Audubon, Falmouth, Maine.

Canadian Wildlife Service. 2002. The seabirds of the St. Lawrence, Québec, Canada: Great black-backed gull. The Green Lane™, Environment Canada's World Wide Web site, Québec, Canada. http://lavoieverte.qc.ec.gc.ca/faune/oiseaux_de_mer/html/oiseaux_de_mer_e.html. Accessed January 15, 2003.

Caron, M. 1986. Red Fox Species Assessment. Maine Department of Inland Fisheries and Wildlife. Bangor, Maine.

Chapman, J. A., and G. A. Feldhamer. 1982. Wild Mammals of North America. Baltimore and London: John Hokins University Press.

Chapman, J. A., and G. A. Feldhamer. 2003. Wild mammals of North America. John Hopkins University Press, Baltimore, Maryland.

Chipman, R.B., T.L. Devault, D. Slate, K.J. Preusser, M.S. Carrara, J.W. Friers, and T.P. Algeo. 2008. Non-lethal management to reduce conflicts with winter urban crow roosts in New York: 2002 – 2007. Pp. 88-93 *in* R.M. Timm and M.B. Madon, eds. Proc. 23rd Vertebr. Pest Conf., University of California-Davis.

Chipman, R.B. R. A. Dolbeer, K. J. Preusser, D. P. Sullivan, E. D. Losito, A. L. Gosser, and T. W. Seamans. 2004. Emergency Wildlife Management Response to Protect Evidence Associated with the Terrorist Attack on the World Trade Center, New York City. Proc. 2lst Vertebr. Pest Conf.

Churcher, P. B., and J. H. Lawton. 1987. Predation by domestic cats in an English village. J. Zool. (London) 212:439-455.

Clark, F.W. 1972. Influence of jackrabbit density on coyote population change. Journal of Wildlife Management 36:343-356.

Clode, D., and D. W. Macdonald. 2002. Invasive predators and the conservation of island birds: The case of American Mink *Mustela vison* and terns *Sterna* spp. in the Western Isles, Scotland. Bird Study 49:118-123.

Coleman, J. S., and S. A. Temple. 1989. Effects of free ranging cats on wildlife: a progress report. *In* Proc. Eastern Wildl. Damage Contr. Conf. 4:9-12.

Connolly. 1986. Raccoon Species Assessment. Maine Department of Inland Fisheries and Wildlife. Bangor, Maine.

Connolly, G.E. 1992. Coyote damage to livestock and other resources. Pp 161-169 *in* A.H. Boer, ed.

Ecology and management of the eastern coyote. Wildlife Research Unit. University of New Brunswick, Fredericton, New Brunswick, Canada.

Connolly, G. E. 1995. The effects of control on coyote populations: another look. pp 23-29 *in:* D. Rollins, C. Richardson, T. Blankenship, K. Canon, and S. Henke, eds. Proc. of symposium: Coyotes in the southwest: a compendium of our knowledge. Texas Parks and Wildl. Dept., Austin, Texas.

Connolly, G.E., and W.M. Longhurst. 1975. The effects of control on coyote populations. Univ. Calif., Div. Agric. Sci. Bull. 1872. 37 pp.

Connolly, G.E. 1978. Predator control and coyote populations: A review of simulation models. Pp 327-345 *in* M. Bekoff, ed. Coyotes: Biology, Behavior and Management. Academic Press, New York. 384 pp.

Conover, M. R. 1982. Evaluation of behavioral techniques to reduce wildlife damage. Proc. Wildl.-Livestock Relation. Sym. 10:332-344.

Conover, M. R. 1984. Comparative effectiveness of avitrol, exploders, and hawk-kites in reducing blackbird damage to corn. J. Wildl. Manage. 48:109-116.

Conover, M. R., R. L. King, Jr., J. E. Jimenez, and T. A. Messmer. 2005. Evaluation of supplemental feeding to reduce predation of duck nests in North Dakota. Wildlife Society Bulletin 33:1330-1334.

Cooper, S. M., and T. F. Ginnett. 2000. Potential effects of supplemental feeding of deer on nest predation. Wildlife Society Bulletin 28:660-666.

Cote, I. M., and W. J. Sutherland. 1997. The effectiveness of removing predators to protect bird populations. Conservation Biology 11:395-404.

Courchamp F., J. L. Chapuis, M. Pascal. 2003. Mammal invaders on islands: impact, control, and control impact. Biol. Rev. 78:347-383.

Craig, J. R., J. D. Rimstidt, C. A. Bonnaffon, T. K. Collins, and P. F. Scalon. 1999. Surface water transport of lead at a shooting range. Bulletin of Environmental Contamination and Toxicology 63:312-319.

Craik, C. 1997. Long-term effects on North American mink *Mustela vison* on seabirds in western Scottland. Bird Study 44:303-309.

Craven, S., Barnes, T., and Kania, F. 1998. Toward a professional position on the translocation of problem wildlife. Wildl. Soc. Bull. 26, 171–177.

Crawford, B.A., M.R. Pelton, and K.G. Johnson. 1993. Techniques to monitor relative abundance of coyotes in East Tennessee. Proceedings of Annual Conference, Southeastern Association of Fish and Wildlife Agencies 47:62-70.

Cristol, D.A. 2001. American crows cache less preferred walnuts. Animal Behaviour 62:331-336.

Cristol, D.A. 2005. Walnut-caching behavior of American crows. J. Field Ornithol. 76:27-32.

Cummings, J.L., J.F. Glahn, E.A. Wilson, J.E. Davis, Jr., D.L. Bergman, and G.A. Harper. 1992. Efficacy and nontarget hazards of DRC-1339 treated rice baits used to reduce roosting populations of depredating blackbirds in Louisiana. Denver Wildlife Research Center, Bird Section Res. Rep. No. 481. 40 pp.

Cunningham, D.J., E.W. Schafer, and L.K. McConnell. 1979. DRC-1339 and DRC-2698 residues in starlings: Preliminary evaluation of their effects on secondary hazard potential. Pp 31-35 *in* W.B. Jackson, S.S. Jackson, and B.A. Jackson, eds. Proceedings Eighth Bird Control Seminar. October 30 – November 1, 1979. Bowling Green State University, Bowling Green, Ohio.

Cunningham, D.J., E.W. Schafer, and L.K. McConnell. 1981. DRC-1339 and DRC-2698 residues in European Starlings: preliminary evaluation of their effects on secondary hazard potential. Proc. Bird Control Semin. 8:31-37.

Daigle, J.J., R.M. Muth, R.R. Zwick, and R.J. Glass. 1998. Sociocultural dimensions of trapping: a factor analytical study of trappers in six northeastern states. Wildlife Society Bulletin 26:614–625.

Danner, D.A., and N.S. Smith. 1980. Coyote home range, movement, and relative abundance near a cattle feedyard. Journal of Wildlife Management 44:484-487.

Dauphine, N., and R. J. Cooper. 2009. Impacts of free-ranging domestic cats (*Felix catus*) on birds in the United States: A review of recent research with conservation and management recommendations. Proceedings of the fourth international partners in flight conference: tundra to tropics., McAllen, Texas. http://www.abcbirds.org/abcprograms/policy/cats/pdf/impacts_of_free_ranging_domestic_cats.pdf. Accessed July 23, 2012.

Davidson, W. R. and V. F. Nettles. 1997. Field manual of wildlife diseases in the southeastern United States. 2nd ed. The Univ. of Georgia, Athens, Georgia. 417 pp.

Decker, D. J. and G. R. Goff. 1987. Valuing Wildlife: Economic and Social Perspectives. Westview Press. Boulder, Colorado, 424 pp.

Decino, T.J., D.J. Cunningham, and E.W. Schafer. 1966. Toxicity of DRC-1339 to European starlings. Journal of Wildlife Management 30:249-253.

DeVos, J. C. and J. L. Smith. 1995. Natural mortality in wildlife populations. Intl. Assoc. of Fish and Wildlife Agencies, Washington, DC. 50 pp.

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.

Doherty, P. J., and J. A. Heath. 2011. Factors affecting piping plover hatching success on Long Island, New York. Journal of Wildlife Management 75:109-115.

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., G. E. Bernhardt, T. W. Seamans and P. P. Woronecki. 1991. Efficacy of two gas cartridge formulations in killing woodchucks in burrows. Wildlife Society Bulletin 19:200-204.

Dolbeer, R. A., P. P. Woronecki, and R.L. Bruggers. 1986. Reflecting tapes repel blackbirds from millet, sunflowers, and sweet corn. Wildl. Soc. Bull. 14:418-425.

Drury, W. H. 1973. Population changes in New England seabirds. Bird Banding 44:267-313.

Dunkley, L. and M.R.L. Cattet. 2003. A Comprehensive Review of the Ecological and Human Social Effects of Artificial Feeding and Baiting of Wildlife. Canadian Cooperative Wildlife Health Centre. Saskatoon, Saskatchewan. 70 pp.

Eagle, T. C., and J. S. Whitman. 1987. Mink. Pp 614-625 *in* M. Novak, J. A. Baker, M. E. Obbard, B. Mallock, eds. Wild furbearer management and conservation in North America. Ministry of Natural Resources, Ontario, Canada.

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. Management of North American Blackbirds (Proceedings of a Special Symposium of the TWS 9th Annual Conference). Bismarck, North Dakota.

Eisenberg, J. F. 1989. Mammals of the Neotropics. The Northern Neotropics. The University of Chicago Press, Chicago, Illinois.

Elphick, C., J. B. Dunning, and D.A. Sibley. 2001. The Sibley Guide to Bird Life and Behavior. Alfred A. Knopf, Inc. New York, New York. 608 pp.

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. 1986*a*. Quality Criteria for Water 1986. U.S. Environmental Protection Agency, Publication EPA/440/5-86-001. Washington, D.C.

EPA. 1986*b*. Total Exposure Assessment Model (TEAM) Study: Summary and Analysis, Volume I, Final Report. EPA/600/6-87/002a. Washington, D.C.

EPA. 1991. Reregistration eligibility document: Inorganic nitrate/nitrite (sodium and potassium nitrates). List D, Case 4052. Environmental Protection Agency, Office of Pesticide Programs Special Review and Reregistration Division, Washington, D.C.

EPA. 1995. R.E.D. Facts — Starlicide (3-chloro-p-toluidine hydrochloride). USEPA, Prevention, Pesticides and Toxic Substances. EPA-738-F-96-003. 4 p.

EPA. 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. 2007. Reregistration Eligibility Decision for 4-aminopyridine. United States Environmental Protection Agency, Office of Prevention, Pesticides and Toxic Substances, EPA-738-R-07-013.

Washington, D.C.

Errington, P. L. 1933. Bobwhite winter survival in an area heavily populated with grey fox. Iowa State Coll. J. Sci. 8:127–130. Madison. 504 pp.

Errington, P.L. 1943. An analysis of mink predation upon muskrats in north-central United States. Iowa Agricultural Experiment Station Research Bulletin 320:797-924.

Erwin, R. M. 1979*a*. Historical breeding records of colonial seabirds and wading birds, 1900 – 1977, Cape Elizabeth, Maine to Virginia. supplement to final report prepared for U.S. Fish and Wildlife Service, Coastal Ecosystems Project, Newton Corner, Massachusetts.

Erwin, R. M. 1979*b*. Species interactions in a mixed colony of Common Terns (*Sterna hiundo*) and Black Skimmers (*Rynchops niger*). Anim. Behav. 27:1054-1062.

Erwin, R. M., B. R. Truitt, J. E. Jimenez. 2001. Ground nesting waterbirds and mammalian carnivors in the Virginia barrier island region: running out of options. J. of Coastal Research. 17:292-296.

Fair, J., E. Paul, and J. Jones, eds. 2010. Guidelines to the Use of Wild Birds in Research. Washington, D.C.: Ornithological Council.

FDA. 2003. Bird poisoning of federally protected birds. Office of Criminal Investigations. Enforcement Story 2003.

Felio, J., K. O'Brien, J. Kramer, J. Jones, and S. Gallo. 2008. 2007 Piping Plover and Least Tern Project Report for Maine. Falmouth, Maine.

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.

Fitzgerald, B. M. 1977. Weasel predation on a cyclic population of the montane vole (*Microtus montanus*) in California. Journal of Animal Ecology 46:367-97.

Fitzwater, W. D. 1994. Feral house cats. Pp C45-50 *in* S. E. Hygnstrom, R. M. Timm and G. E. Larson, eds. Prevention and control of wildlife damage. University of Nebraska-Lincoln, Lincoln, Nebraska.

Follmann, E. H. 1973. Comparative ecology and behavior of red and gray fox. Thesis, Southern Illinois University-Carbondale, Carbondale, Illinois.

Ford, H.S. 1967. Winter starling control in Idaho, Nevada, Oregon. Proceedings: Third Vertebrate Pest Conference 3:104-110.

Fowler, M. E., and R. E. Miller. 1999. Zoo and wild animal medicine. W.B. Saunders Company, Philadelphia, Pennsylvania.

Fritzell, E. K. 1987. Gray fox and island fox. Pp 408-420 *in* M. Novak, J. A. Baker, M. E. Obbard, B. Mallock, eds. Wild furbearer management and conservation in North America. Ministry of Natural Resources, Ontario, Canada.

Galbraith, H., R. Jones, R. Park, J. Clough, S. Herod-Julius, B. Harrington, and G. Page. 2002. Global

climate change and sea level rise: potential losses of intertidal habitat for shorebirds. Waterbirds. 25:173–183.

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.

Gardner, A.L. 1982. Virginia opossum. Pp 3-36 *in* J. A. Chapman and G. A. Feldhamer, eds. Wild mammals of North America: biology, management, and economics. Johns Hopkins University Press, Baltimore, Maryland. 1147 pp.

Gerell, R. 1971. Population studies on mink, *Mustela vison* (Schreber), in southern Sweden. *Viltrevy* 8:83-114.

Gier, H. T. 1948. Rabies in the wild. J. Wildl. Manage. 12:142–153.

Gier, H. T.. 1968. Coyotes in Kansas. Rev. ed. Kansas State Coll., Agric.Exp. Stn. Bull. 393. 118 pp.

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., and E.A. Wilson. 1992. Effectiveness of DRC-1339 baiting for reducing blackbird damage to sprouting rice. Proc. East. Wildl. Damage Cont. Conf. 5:117-123.

Glahn, J. F., S. K. Timbrook, and D. J. Twedt. 1987. Temporal use patterns of wintering European Starlings at a southeastern livestock farm: implications for damage control. Proc. East. Wildl. Damage Control Conf. 3:194-203.

Glahn, J.F., E.A. Wilson, and M.L. Avery. 1990. Evaluation of a DRC-1339 baiting program to reduce sprouting rice damage caused by spring roosting blackbirds. U. S. Department of Agriculture, Animal Damage Control, Denver Wildl. Res. Ctr., Bird Sect. Res. Rep. No. 448.

Glahn, J. F., G. Ellis, P. Fiornelli, and B. Dorr. 2000. Evaluation of low- to moderate-power lasers for dispersing double-crested cormorants from thier night roosts. Proceedings of the Ninth Wildlife Damage Management Conference. 9:34-45.

Glover, F.A. 1942. A population study of weasels in Pennsylvania. M.S. Thesis, Pennsylvania State College.

Glover, F.A. 1943. A study of the winter activities of the New York weasel. Pennsylvania Game News 14:8–9.

Godin, A.J. 1977. Wild Mammals of New England. Johns Hopkins University Press. Baltimore, Maryland. 304 pp.

Good, T. P. 1998. Great Black-backed Gull (*Larus marinus*). *In* The Birds of North America, No. 330 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA. http://bna.birds.cornell.edu/BNA/. Accessed August 24, 2009.

Gorenzel, W.P., and T.P. Salmon. 1995. Characteristics of American crow urban roosts in California. Journal of Wildlife Management 59:638-645.

Gorenzel, W.P., B.F. Blackwell, G.D. Simmons, T.P. Salmon, and R.A. Dolbeer. 2002. Evaluation of laser to disperse American crows, *Corvus brachyrhynchos*, from urban night roosts. Int. J. Pest Manage. 48:327-331.

Graves, G. E. and W. F. Andelt. 1987. Prevention and control of woodpecker damage. Service in Action, Colo. St. Univ. Coop. Ext. Serv. Publ. No. 6.516. Ft. Collins, Colo. 2 pp.

Green, J. S., and P. S. Gipson. 1994. Feral dogs. Pp C77-C82 *in* S. E. Hygnstrom, R. M. Timm, and G. E. Larson, eds. Prevention and control of wildlife damage. University of Nebraska-Lincoln, Lincoln, Nebraska.

Green, J. S., F. R. Henderson, and M. D. Collinge. 1994. Coyotes. Pp C51-C76 *in* S. E. Hygnstrom, R. M. Timm, and G. E. Larson, eds. Prevention and control of wildlife damage. University of Nebraska-Lincoln, Lincoln, Nebraska.

Greenlaw, J. S., and W. J. Sheehan. 2003. The current status and history of ring-billed gulls (*Larus delawarensis*) inMaine. Northeastern Naturalist. 10:55-66.

Greenwood, R. J., D. G. Pietruszewski, and R. D. Crawford. 1998. Effects of food supplementation on depredation of duck nests in upland habitat. Wildl. Soc. Bull. 26:219-226.

Greenwood, R. J., P. M. Arnold and B. G. McGuire. 1990. Protecting duck nests from mammalian predators with fences, traps, and a toxicant. Wildl. Soc. Bull. 18:75-82.

Griffith, D.M., and Alerich, C.L. 1996. Forest statistics for Maine 1995. U.S. For. Serv. Resour. Bull. NE-135.

Grinnell, J., J. S. Dixon, and J. M. Linsdale. 1937. Fur-bearing mammals of California. 2 vols. Univ. California Press, Berkeley. 777 pp.

Grizzell, Jr., R. A. 1955. A study of the southern woodchuck, *Marmota monax monax*. American Midland Naturalist 53:257-93.

Hall, E. R., and K. R. Kelson. 1959. The mammals of North America. Vol. 2. The Ronald Press Co., New York, N. Y. 616 pp.

Hall, E.R. 1981. The Mammals of North America. 2 volumes. Ronald Press Co.

Hallberg, D.L., and G.R. Trapp. 1984. Gray fox temporal and spatial activity in a riparian–agricultural zone in California's Central Valley. Pp 920-928 *in* R. E. Warner and K. M. Hendrix, eds. Proceedings of the California Riparian Systems Conference. University of California Press, Berkeley, California.

Hamilton, Jr., W.J. 1933. The weasels of New York. American Midland Naturalist 14:289-337.

Hamilton, Jr., W.J. 1934. The life history of the rufescent woodchuck *Marmota monax rufescens* Howell. Ann. Carnegie Museum 23:85-178.

Haroldson, K.J., and E.K. Fritzell. 1984. Home ranges, activity, and habitat use by gray fox in an oak–hickory forest. Journal of Wildlife Management 48:222-227.

Harris, S, and J. M. V. Rayner. 1986. Urban fox (*Vulpes vulpe*s) population estimates and habitat requirements in several British cities. J. Anim. Ecol. 55:575–591.

Harris, S. 1977. Distribution, habitat utilization and age structure of a suburban fox (*Vulpes vulpes*) population. Mammal Rev. 7: 25-39.

Harris, S. 1979. Age related fertility and productivity in red fox, *Vulpe vulpes*, in suburban London. J. Zool. (London) 187:195-199.

Harrison, D. J. 1992. Social ecology of coyotes in northeastern North America: Relationships to dispersal, food resources, and human exploitation. Pages 53-72 *in* A. H. Boer, ed. Ecology and management of the eastern coyote. Wildlife Research Unit, University of New Brunswick, Fredericton, New Brunswick.

Hatch, J.J. 1970. Predation and Piracy by Gulls at a Ternery in Maine. The Auk 87:244-254.

Hatler, D. F. 1976. The coastal mink on Vancouver Island, British Columbia. Ph.D. Thesis, Univ. British Columbia, Vancouver. 296 pp.

Hecht, A., and S. M. Melvin. 2009. Population Trends of Atlantic Coast Piping Plovers, 1986-2006. Waterbirds 32:64-72.

Henderson, F.E. 1994. Weasels. Pp C-119-C- 122 *in* S. E. Hygnstrom, R. M. Timm and G. E. Larson, eds., Prevention and Control of Wildlife Damage. Univ. Nebr. Coop. Ext., USDA-APHIS-ADC, and Great Plains Agric. Council Wildl. Comm., Lincoln, Nebraska.

Heske, E. J., S. K. Robinson, and J. D. Brown. 2001. Nest predation and neotropical migrant songbirds: piecing together the fragments. Wildl. Soc. Bull. 29:52-61.

Heusmann, H. W. and R. Bellville. June 1978. Effects of Nest Removal on Starling Populations. Wilson Bulletin 90:287-290.

Hoagland, J.W. 1993. Nuisance beaver damage control proposal. Oklahoma Department of Wildlife Conservation. Internal Document. 20 pp.

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.

Honacki, J. H., K. E. Kinman, and J. W. Koeppl, editors. 1982. Mammal species of the world: a taxonomic and geographic reference. Allen Press, Inc., and Assoc. Systematics Collections, Lawrence, Kans. 694 pp.

Houston, C. S., D. G. Smith, and C. Rohner. 1998. Great Horned Owl (*Bubo virginianus*). 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/372.

Humphrey, J. S., E. A. Tillman, and M. L. Avery. 2001. Guidelines for using effigies to disperse

nuisance vulture roosts. National Wildlife Research Center. Mimeo. July 2001. 2 pp.

Hunt, J H. 1986. Mink Assessment. Maine Department of Inland Fisheries and Wildlife. Bangor, Maine.

Intergovernmental Panel on Climate Change. 2007. Climate Change 2007: The physical science basis. Contribution of Working Group I to the fourth assessment report of the Intergovernmental Panel on Climate Change: Cambridge University Press, Cambridge, United Kingdom and New York, New York.

Jackson, J. J. 1994. Opossums. Pp D59-64 *in* S.E. Hygnstrom, R.M. Timm and G.E. Larson, eds., Prevention and Control of Wildlife Damage. Univ. Nebr. Coop. Ext., USDA-APHIS-ADC, and Great Plains Agric. Council Wildl. Comm., Lincoln, Nebraska.

Jakubas, W. 1999. Coyote Species Assessment. Maine Department of Inland Fisheries and Wildlife. Bangor, Maine.

Johnson, R.J. 1994. American Crows. Pp 33-40 *in* S. E. Hyngstrom, R. M. Timm, and G. E. Larson, eds. Prevention and control of wildlife damage. Univ. Of Nebraska, Lincoln, Nebraska.

Johnson, R.J., and J.F. Glahn. 1994. European Starlings. Pp 109 - 120 *in* S. E. Hygnstrom, R.M. Timm, and G.E. Larson, eds. Prevention and control of wildlife damage - 1994. Univ. NE Coop. Ext., Instit. o f Ag. and Nat. Res., Univ. of NE-Lincoln, USDA, APHIS, ADC, Great Plains Ag. Council Wildl. Committee.

Johnson, M.R., R.G. McLean, and D. Slate. 2001. Field operations manual for the use of immobilizing and euthanizing drugs. USDA, APHIS, WS Operational Support Staff, Riverdale, Maryland.

Johnson, M., and L. W. Oring. 2002. Are nest exclosures an effective tool in plover conservation? International Journal 25:184-190.

Johnson, M.R., R.G. McLean, and D. Slate. 2001. Field operations manual for the use of immobilizing and euthanizing drugs. USDA, APHIS, WS Operational Support Staff, Riverdale, Maryland.

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.

Kadlec, J.A. 1968. Bird reactions and scaring devices. Append. 1. Fed. Aviation Advis. Circ. 150-5200-9.

Kadlec, J. A., and W. H. Drury, Jr. 1968. Structure of the New England Herring Gull population. Ecology. 49:644-676.

Kamler, J. F., and W. B. Ballard. 2002. A review of native and nonnative red foxes in North America. Wildlife Society Bulletin 30:370-379.

Kendall, R.J., T. E. Lacker 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. Environmental Toxicology and Chemistry. 15:4-20.

Kennedy, M. L., J. P. Nelson, Jr., F. W. Weckerly, D. W. Sugg, and J. C. Stroh. 1991. An assessment of selected forest factors and lake level in raccoon management. Wild. Soc. Bull. 19:151-154.

Kennely, J. J., and B. E. Johns. 1976. The estrous cycle of coyotes. J. Wildl. Manage. 40:272-277.

Kern, W. H., Jr. 2002. Raccoons. WEC-34. Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida.

Kernohan, B. J., R. A. Gitzen, and J. J. Millspaugh. 2001. Analysis of animal space use and movements. Pp 125-166 *in* J. J. Millspaugh and J. M. Marzluff, eds., Radio tracking and animal populations. Academic Press, San Diego, California.

Kharitonov, S. P., and D. Siegel-Causey. 1988. Colony formation in seabirds. Current Ornithology 5: 223-227.

Kilham, L. 1989. The American crow and the common raven. Texas A&M Univ. Press, College Station.

King, C.M. 1989. The natural history of weasels and stoats. Cornell University Press. Ithaca, New York. 253 pp.

Knittle, C.E., E.W. Schafer, Jr., and K.A. Fagerstone. 1990. Status of compound DRC-1339 registration. Vertebr. Pest Conf. 14:311-313.

Knowlton, F. F. 1972. Preliminary interpretations of coyote population mechanics with some management implications. J. Wildl. Manage. 36:369-383.

Knowlton, F.F., and L.C. Stoddart. 1985. Coyote population mechanics: Another look. Pp 93-111 *in* F.L. Bunnell, D.S. Eastman, and J.M. Peck, eds. Symposium on the Natural Regulation of Wildlife Populations. University of Idaho, Moscow, Idaho.

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.

Koenen, M. T., R. B. Utych, and D. M. Leslie, Jr. 1996. Methods used to improve least tern and snowy plover nesting success on alkaline flats. Journal of Field Ornithology 67:281-291.

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.

Kress, S. W., and C. S. Hall. 2002. Tern Management Handbook: Coastal Northeastern United States and Atlantic Canada. U.S. Dept. Int., Fish Wildl. Serv., Hadley, Maryland.

LaGrange, T. G., J. L. Hansen, R. D. Andrews, A. W. Hancock, and J. M. Kienzler. 1995. Electric fence predator exclosure to enhance duck nesting: a long-term case study in Iowa. Wildl. Soc. Bull. 23:261-266.

Laidlaw, M. A. S., 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). Environmental Health Perspectives. 113:793–800.

Lariviere, S. 2004. Range expansion of raccoons in the Canadian prairies: review of hypotheses. Wildlife Society Bulletin 32:955-963.

Latham, R.M. 1960. Bounties are bunk. National Wildlife Federation, Washington, D.C. 10 pp.

Leatherman, S., R. Chalfont, E. Pendleton, T. McCandless, and S. Funderburk. 1995. Vanishing lands: Sea level, society and Chesapeake Bay. Chesapeake Bay Field Office, USFWS, Annapolis, Maryland.

Leopold, A. 1943. Deer irruptions. Transactions of the Wisconsin Academy of Sciences, Arts, and Letters 35:351–366.

Link, W.A., and Sauer, J.R. 1998. Estimating population change from count data: application to the North American Breeding Bird Survey. Ecological Applications 8:258-268.

Link, W. A., and J. R. Sauer. 2002. A hierarchical model of population change with application to Cerulean Warblers. Ecology 83:2832-2840.

Linscombe, G., N. Kinler, and R. J. Aulerich. 1982. Mink. Pp 629-643 *in* J. A. Chapman and G. A. Feldhamer, eds. Wild mammals of North America: biology, management, and economics. Johns Hopkins University Press, Baltimore, Maryland.

Linz, G.M., H.J. Homan, and W.J. Bleier. 1999. Blackbird densities and sunflower damage in North Dakota and South Dakota: 1996-1998. Pp. 136-139 *in* L. Kroh, ed. Proceedings of the 21st Sunflower Research Workshop. (January 14-15, 1999, Fargo, North Dakota). National Sunflower Association, Bismarck, North Dakota.

Linz, G.M., D.A. Schaaf, R.L. Wimberly, H.J. Homan, T.L. Pugh, B.D. Peer, P. Mastrangelo, and W.J. Bleier. 2000. Efficacy and potential nontarget impacts of DRC-1339 avicide use in ripening sunflower fields: 1999 progress report. Pp. 162-169 *in* L. Kroh, ed.Proceedings of the 22nd Sunflower Research Workshop. (January 18-19, 2000, Fargo, North Dakota). National Sunflower Association, Bismarck, North Dakota.

Linzey, D. W. 1998. The Mammals of Virginia. Mcdonald and Woodward Pub. Co., Blacksburg, Virginia.

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.

Lokemoen, J. T., H. A. Doty, D. E. Sharp, and J. E. Neaville. 1982. Electric fences to reduce mammalian predation on waterfowl nests. Wildl. Soc. Bull. 10: 318-323.

Lord, R. D., Jr. 1961. A population study of the gray fox. Am. Midl. Nat. 66:87–109. Sci. 38:79–82.

MacDonald, D. W., and M. T. Newdick. 1982. The distribution and ecology of fox, *Vulpes vulpes* (L.), in urban areas. Pp 123–135 *in* R. Bornkamm, J. A. Lee, and M. R. D. Seaward, eds. Urban

ecology. Blackwell Scientific Publications, Oxford, United Kingdom.

MDIFW. 2005. Maine's Comprehensive Wildlife Conservation Strategy. Augusta, Maine.

MDIFW. 2006. Island Nesting Terns Assessment, Bangor, Maine.

MDIFW. 2007*a*. Piping Plover Management System and Database. Bangor, Maine.

MDIFW. 2007*b*. Least Tern Management System and Database. Bangor, Maine.

MDIFW. 2009. Island Nesting Terns Management System and Database, Bangor, Maine.

MDIFW. 2010. 2010-2011 Trapper Information. Augusta, Maine.

MDIFW. 2011*a*. Maine Endangered Species Program: Piping Plover. http://www.maine.gov/ifw/wildlife/species/endangered_species/piping_plover/. Accessed on February 17, 2011.

MDIFW. 2011*b*. Maine Endangered Species Program: Least Tern. http://www.maine.gov/ifw/wildlife/species/endangered_species/least_tern/index.htm. Accessed on February 17, 2011.

MDIFW. 2011*c*. Maine Endangered Species Program: Roseate Tern. http://www.maine.gov/ifw/wildlife/species/endangered_species/roseate_tern/index.htm. Accessed on February 17, 2011.

MDIFW. 2011*d*. 2011-2012 Trapper Information. Augusta, Maine.

MDIFW. 2012. Maine Hunting and Trapping. Maine Department of Inland Fisheries and Wildlife. Augusta, Maine.

Marshall, W. H. 1936. A study of the winter activities of the mink. J. Mammal. 17:382-392.

Martin, T. E. 1992. Breeding productivity considerations: what are the appropriate habitat features for management? Pp 455-473 *in* J. M. Hagan III and D. W. Johnson, eds., Ecology and conservation of Neotropical migrant landbirds. Smithsonian Institution, Washington, DC.

Marzluff, J.M., K.J. McGowan, R. Donnelly, and R.L. Knight. 2001. Causes and consequences of expanding American Crow populations. Pp 332-363 *in* Avian ecology and conservation in an urbanizing world. Kluwer Academic Press, Norwell, Massachusetts.

Mason, J.R. 1989. Avoidance of methiocarb-poisoned apples by Red-winged Blackbirds. Journal of Wildlife Management 53:836-840.

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.

Mabee, T. 1997. Using eggshell evidence to determine nest fate of shorebirds. Wilson Bulletin 109:307-313.

Mayer, P.M. and M.R. Ryan. 1991. Electric Fences Reduce Mammalian Predation on Piping Plover

Nests and Chicks. Wildlife Society Bulletin. 19:59-63.

MacLean, S. F., Jr., B. M. Fitzgerald, and F. A. Pitelka. 1974. Population cycles in arctic lemmings: winter reproduction and predation by weasels. Arctic and Alpine Research 6:1-12.

McCabe, R. A. 1949. Notes on live-trapping mink. J. Mammal. 30:416-423.

McCollough, M. A. 1993. Least Tern Assessment. Maine Department of Inland Fisheries and Wildlife. Bangor, Maine.

McCollough, M. A. 2000. Piping Plover Assessment. Maine Department of Inland Fisheries and Wildlife. Bangor, Maine.

McKillop, I. G. and R. M. Sibly. 1988. Animal behaviour at electric fences and the implications for management. Mammal Rev. 18:91-103.

McKnight, T. 1964. Feral livestock in Anglo-America. University of California Publications in Geography Vol. 16. University of California Press, Berkeley, California.

Megyesi, J. L. 1998. Management for avian nesting diversity on the northern end of South Monomoy Island: 1997 field season report. Environment Cape Code 1:15-37.

Melvin, S.M., L.H. MacIvor, and C.R. Griffin. 1992. Predator Exclosures: A Technique to Reduce Predation at Piping Plover Nests. Wildlife Society Bulletin. 20:143-148.

Messmer, T. A., M. W. Brunson, d. Reiter, and D. G. Hewitt. 1999. United States public attitudes regarding predators and management to enhance avian recruitment. Wildl. Soc. Bull. 27:75-85.

MANEM Regional Waterbird Plan. 2006. Waterbird Conservation Plan: 2006-2010. http://www.manomet.org/pdf/waterbird07/waterbird_species_profiles.pdf. Accessed September 7, 2009.

Miller, L.A. 1995. Immunocontraception as a tool for controlling reproduction in coyotes. Pp 172-176 *in* D. Rollins, C. Richardson, T. Blankenship, K. Canon, and S. Henke, eds. Coyotes in the Southwest: A Compendium of Our Knowledge. Proc. of a Symposium, Dec. 13-15, Texas A&M University, San Angelo, Texas.

Miller, R., J. B. Kaneene, S. D. Fitzgerald, and S. M. Schmitt. 2003. Evaluation of the influence of supplemental feeding of white-tailed deer (*Odocoileus virginianus*) on the prevalence of bovine tuberculosis in the Michigan wild deer population. Journal of Wildlife Diseases. 39:84-95.

Mitchell, J. L. 1961. Mink movements and populations on a Montana river. Journal of Wildlife Management 25:48-54.

Mott, D. F. 1985. Dispersing blackbird-starling roosts with helium-filled balloons. Proceedings of the East. Wildlife Damage Conference 2:156-162.

Muller, L. I., R. J. Warren, and D. L. Evans. 1997. Theory and Practice of immunocontraception in wild animals. Wildlife Society Bulletin 25:504-514.

Murphy, R. K., I. M. Michaud, D. R. C. Prescott, J. S. Ivan, B. J. Anderson, and M. L. French-Pombier.

2003. Predation on adult piping plovers at predator exclosure cages. Waterbirds 26:150-155.

NAS. 2010. The Christmas Bird Count Historical Results [Online]. Available http://www.christmasbirdcount.org. Accessed on February 17, 2011.

National Audubon Society. 2000. Field guide to North American mammals. J. O. Whitaker, Jr., ed. Indiana State Univ. Alfred A. Knopf, New York, N.Y. 937 pp.

Nelson, H. K. 2001. Impact of predation on avian recruitment: an introduction. Wildl. Soc. Bull. 29:2-5.

Nettleship, D. N., J. Burger, and M. G. Gochfeld. 1994. Seabirds on Islands: threats, case studies, and action plans. Cambridge, England: Birdlife International. 318 pp.

Nicholson, W. S. 1982. An ecological study of the gray fox in east central Alabama. Thesis, Auburn University, Auburn, Alabama.

Niehaus, A. C., D. R. Ruthrauff, and B. J. McCaffery. 2004. Response of predators to western sandpiper nest exclosures. Waterbirds 27:79-82.

Nielsen, L. 1988. Definitions, considerations, and guidelines for translocation of wild animals. Pp 12-49 *in* L. Nielsen and R. D. Brown, eds., Translocation of wild animals. Wisconsin Humane Society, Milwaukee, Wisconsin, and Caesar Kleberg Wildlife Research Institute, Kingsville, Texas.

Nisbet, I. C. T. 1989. Status and biology of the northeastern population of the roseate tern. U.S. Fish and Wildlife Service, Newton Corner, MA. 74 pp.

Noble, A. C. 1980. Effect of Use of the Bird Repellant Mesurol on Wine Composition and Flavor. American Journal of Enology and Viticulture 31:98-100.

Nowak, R. M. 2002. The original status of wolves in eastern North America. Southeast. Nat. 1:95–130.

Nupp, T. E., and R. K. Swihart. 1998. Effects of Forest Fragmentation on Population Attributes of White-Footed Mice and Eastern Chipmunks. Journal of Mammalogy 79:1234-1243.

Osgood, F.L. 1935. Fluctuations in small mammal populations. Journal of Mammalogy 16:156.

Palmer, R.S. 1954. The mammal guide. Doubleday and Company, Inc. Garden City, New York.

Paradiso, J. L. 1969. Red fox . Pp 134 – 139 *in* Mammals of Maryland. North American Fauna, No. 66. Bureau of Sport Fisheries and Wildlife. Washington, D.C.

Parker, G. 1995. Eastern coyote: The story of its success. Nimbus Publishing, Halifax, Canada.

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.

Pfeifer, W. K., and M. W. Goss. 1982. Guard dogs and gas exploders as coyote depredation control tools in North Dakota. Proc. Vertebr. Pest Conf. 10:55-61.

Phillips, R. L. 1970. Age ratio of Iowa foxes. J. Wildl. Manage. 34:52-56.

Phillips, R. L., and K. S. Gruver. 1996. Performance of the Paws-I-Trip pan tension device on 3 types of traps. Wildl. Soc. Bull. 24:119-122.

Phillips, R. L., and R. H. Schmidt. 1994. Fox. Pp C83-C88 *in* S. E. Hygnstrom, R. M. Timm and G. E. Larson, eds. Prevention and control of wildlife damage. University of Nebraska-Lincoln, Lincoln, Nebraska.

Pierotti, R. J., and Good T. P. 1994. Herring gull. The Birds of North America, No. 124.

Pietz, P. J. and G. L. Krapu. 1994. Effects of predator exclosures design on duck brood movements. Wildl. Soc. Bull. 22:26-33.

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.

Pulliam, H. R. 1988. Sources, sinks, and population regulation. American Naturalist 132:757-785.

Pyrah, D. 1984. Social distribution and population estimates of coyotes in north-central Minnesota. Journal of Wildlife Management 48:679-690.

Quick, H.F. 1951. Notes on the ecology of weasels in Gunnison County, Colorado. Journal of Mammalogy 32:281-290.

Reitsma, L. R., Holmes, R. T. and Sherry, T. W. 1990. Effects of removal of red squirrels, and eastern chipmunks, on nest predation in a northern hardwood forest: an artificial nest experiment. Oikos 57: 375-380.

Reynolds, J. C., and S. C. Tapper. 1996. Control of mammalian predators in game management and conservation. Mammal Rev. 26:127-156.

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.

Riley S. P., D. J. Hadidian, and D. A. Manski. 1998. Population density, survival, and rabies in raccoons in an urban national park. Canadian Journal of Zoology. 76:1153–1164.

Ripple, W. J., and R. L. Beschta. 2006. Linking a cougar decline, trophic cascade, and catastrophic regime shift in Zion National Park. Biological Conservation. 133: 397-408.

Ripple, W. J., and R. L. Beschta. 2008. Wolves, trophic cascades, and rivers in the Olympic National Park, USA. Ecohydrology 1:118-130.

Ritcey, R. W., and R. Y. Edwards. 1956. Live trapping mink in British Columbia. J. Mammal. 37:114-116.

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.

Rolland, C., E. Danchin, and M. Fraipont. 1998. The evolution of coloniality in birds in relation to food, habitat, predation, an life history traits: a comparative analysis. America Naturalist 151:514-529.

Rosatte, R.C. 1987. Skunks. Pp 599-613 *in* M. Novak, J. A. Baker, M. E. Obbard, and B. Mallock, eds. Wild furbearer management and conservation in North America. Ministry of Natural Resources, Ontario, Canada.

Rossbach, R. 1975. Further experiences with the electroacoustic method of driving starlings from their sleeping areas. Emberiza 2:176-179.

Rowsell, H. C., J. Ritcey, and F. Cox. 1979. Assessment of humaneness of vertebrate pesticides. Proceeding CALAS. University of Guelph, Ontario.

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.

Runge, M. C., W. L. Kendall, and J. D. Nichols. 2004. Exploitation. Pages 303-328 in W. J. Sutherland, I. Newton, and R. E. Green, eds. Bird Ecology and Conservation: A Handbook of Techniques. Oxford University Press, Oxford, United Kingdom.

Runge, M. C., J. R. Sauer, M. L. Avery, B. F. Blackwell and M. D. Koneff. 2009. Assessing allowable take of migratory birds: black vultures in Virginia. Journal of Wildlife Management 73:556-565.

Ryder, J.P. 1993. Ring-billed gull (*Larus delawarensis*). *In* The Birds of North America, No. 33 (A. Poole and F. Gill, eds). The Academy of Natural Sciences, Philadelphia, PA and the American Ornitholiogists Union, Washington, D.C.

Samuel, D. E., and B. B. Nelson. 1982. Foxes. Pp 475-490 *in* J. A. Chapman and G. A. Feldhamer, eds. Wild Mammals of North America. The John Hopkins University Press, Baltimore, Maryland.

Sanderson, G. C. 1987. Raccoons. Pp. 486-499 in M. Novak, J. A. Baker, M.E. Obbard, B. Mallock, eds., Wild Furbearer Management and Conservation in North America. Ministry of Natural Resources, Ontario, Canada. 1150 pp.

Sargeant, A. B. and A. D. Kruse. 1974. Use of small fences to protect ground bird nests from mammalian predators. Prairie Nat. 6:60-63.

Sauer, J. R., and W. A. Link. 2011. Analysis of The North American Breeding Bird Survey Using Hierarchical Models. The Auk 128:87-98.

Sauer, J. R., J. E. Hines, J. E. Fallon, K. L. Pardieck, D. J. Ziolkowski, Jr., and W. A. Link. 2011. The North American Breeding Bird Survey, Results and Analysis 1966 - 2010. Version 12.07.2011 USGS Patuxent Wildlife Research Center, Laurel, Maryland.

Schafer, E.W., Jr. 1972. The acute oral toxicity of 369 pesticidal, pharmaceutical and other chemicals to wild birds. Toxicol. Appl. Pharmacol. 21:315-330.

Schafer, E.W., Jr. 1981. Bird control chemicals - nature, modes of action, and toxicity. Pp. 129-139 *in*

CRC handbook of pest management in agriculture. Vol. 3. CRC Press, Cleveland, 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.

Schmidt, R. H. 1989. Animal welfare and wildlife management. Trans. N. A. 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.

Scott, M. D., and K. Causey. 1973. Ecology of feral dogs in Alabama. Journal of Wildlife Management 37:253-265.

Seaman, T.W, C.R. Hicks, and K.J. Preusser. 2007. Dead bird effigies: A nightmare for gulls? Bird Strike Committee Proceedings, 9th Annual Meeting, Kingston, Ontario.

Seamans, M., F. Rivera-Milan, and M. Koneff. 2007. Estimation of potential biological removal of great black-backed, herring, laughing and ring-billed gulls from Bird Conservation Regions 14 and 30. U.S. Fish and Wildlife Service, Unpubl. Rep. 13 pp.

Seidensticker, J., M. A. O'Connell, and A. J. T. Johnsingh. 1987. Virginia Opossum. Pp 247-261 *in* M. Novak, J. A. Baker, M. E. Obbard, and B. Malloch, eds., Wild Furbearer Management and Conservation in North America. Ontario Ministry of Natural Resour., Ontario Trappers Assoc., North Bay.

Seimer, W. F., G. R. Batcheller, R. J. Glass, and T. L. Brown. 1994. Characteristics of Trappers and Trapping Participation in New York. Wildlife Society Bulletin. 22:100-111.

Sheffield, S.R., and H.H. Thomas. 1997. *Mustela frenata*. Mammalian Species 570:1-9.

Shirota, Y.M. and S. Masake. 1983. Eyespotted balloons are a device to scare gray starlings. Appl. Ent. Zool. 18:545-549.

Simms, D.A. 1979. Studies of an ermine population in Ontario. Can. J. Zool. 57:824-32.

Slade, N. A., R. Gomulkiewicz, and H. M. Alexander. 1998. Alternatives to Robinson and Redford's method of assessing overharvest from incomplete demographic data. Conservation Bi-ology 12:148-155.

Slate, D. 1980. A study of New Jersey raccoon populations— determination of the densities, dynamics and incidence of disease in raccoon populations in New Jersey. N.J. Div. Fish, Game, and Wildl., Pittman-Robertson Proj. W-52-R-8, Final Rep. 67 pp.

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.

Small, M. F., and M. L. Hunter. 1988. Forest fragmentation and avian nest predation in forested landscapes. Oecologia 76:62-64.

Smallwood, J. A., and D. M. Bird. 2002. American Kestrel (*Falco sparverius*). 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/602.

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.

Soule, M. E., D. T. Bolger, A. C Alberts, R. Wright, J. M. Sorice, and S. Hill. 1988. Reconstructed dynamics of rapid extinctions of chaparral-requiring birds in urban habitat islands. Conservation Biology 2:75-92.

Sovada, M. A., R. M. Anthony, and B. D. J. Bratt. 2001. Predation on waterfowl in artic tundra and prairie breeding areas: a review. Wildl. Soc. Bull. 29:6-15.

Stansley, W., L. Widjeskog, and D. E. Roscoe. 1992. Lead Contamination and Mobility in Surface Water at Trap and Skeet Ranges. Bull. Environ. Contam. Toxicol. 49:640-647.

Steinkamp, M. 2008. New England/Mid-Atlantic Coast Bird Conservation Region (BCR 30) Implementation Plan. Atlantic Coast Joint Venture, Laurel, MD. [Online.] http://www.acjv.org/BCR_30/BCR30_June_23_2008_final.pdf.

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.

Stoudt, J. H. 1982. Habitat use and productivity of canvasbacks in southwestern Manitoba, 1961-72. Pec. Sci. Rept. Wildl. 248. U.S. Fish and Wildlife Service. Washington, D.C. 31 pp.

Sullivan, B.D., and J.J. Dinsmore. 1990. Factors affecting egg predation by American crows. Journal of Wildlife Management 54:433-437.

Svendsen, G.E. 1990. Weasels. Pp 613-628 *in* J.A. Chapman, G.A. Feldhamer, eds. Wild Mammals of North America: Biology, Management, and Economics. The Johns Hopkins University Press, Baltimore, Maryland. 1147 pp.

Swift, B. L. 1998. Response of resident Canada geese to chasing by trained border collies. Unpub. Report. NY Dept. of Environ. Conser. Delmar, New York. 6 pp.

Swihart, R. K., and P. M. Picone. 1995. Use of woodchuck burrows by small mammals in agricultural habitats. American Midland Naturalist 133:360-363.

Taylor, B. L., P. R. Wade, D. P. Master, and J. Barlow. 2000. Incorporating uncertainty into management models for marine mammals. Conservation Biology. 14:1243-1252.

Terborgh, J., L. Lopez, P. V. Nunez, M. Rao, G. Shahabuddin, G. Orihuela, M. Riveros, R. Ascanio, G. H. Adler, T. D. Lambert, and L. Balbas. 2001. Ecological meltdown in predator-free forest fragments. Science 294:1924–1925.

The Wildlife Society. 2010. Final TWS Position Statement: Feral and Free-Ranging Domestic Cats. Bethesda, Maryland.

Till, J. A., and F. F. Knowlton. 1983. Efficacy of denning in alleviating coyote depredations upon domestic sheep. J. Wildl. Manage. 47:1018-1025.

Tillman, E. A., J. S. Humphrey, and M. L. Avery. 2002. Use of vulture carcasses and effigies to reduce vulture damage to property and agriculture. Proc. Vertebrate Pest Conference 20:123-128.

Trapp, G. R. 1978. Comparative behavioral ecology of the ringtail *(Bassariscus astutu*s) and gray fox (*Urocyon cinereoargenteu*s) in southwestern Utah. Carnivore 1:3–32.

Trottier, G. C., D. C. Duncan, and S. C. Lee. 1994. Electric predator fences delay mallard brood movements to water. Wildl. Soc. Bull. 22:22-26.

Tobin, M. E., P. P. Woronecki, R. A. Dolbeer, R. L. Bruggers. 1988. Reflecting tape fails to protect ripening blueberries from bird damage. Wildl. Soc. Bull. 16:300-303.

Turkowski, F.J., A.R. Armistead, and S.B. Linhart. 1984. Selectivity and effectiveness of pan tension devices for coyote foothold traps. J. Wildl. Manage. 48:700-708.

Twichell, A. R., and H. H. Dill. 1949. One hundred raccoons from one hundred and two acres. Journal of Mammalogy 30:130–133.

United States Census Bureau. 2000. Statistical Abstract of the United States. U.S. Department of Commerce, Economics and Statistics Administration. Washington DC. 1005 pp.

USDA. 1997. Animal Damage Control Program: Final Environmental Impact Statement (revised). USDA/APHIS/WS-Operational Support Staff, 4700 River Road, Unit 87, Riverdale, Maryland 20737.

USDA. 2001*a*. Environmental Assessment: Reducing pigeon, starling, sparrow, blackbird, raven, and crow damage through an integrated wildlife damage management program in the State of Maine. USDA/APHIS/WS, Augusta, Maine.

USDA. 2001*b*. Compound DRC-1339 Concentrate-Staging Areas. Tech Note. USDA/APHIS/WS. National Wildlife Research Center, Fort Collins, Colorado.

USDA. 2005. Supplemental environmental assessment: Oral vaccination to control specific rabies virus variants in raccoons, gray fox, and coyotes in the United States. USDA/APHIS/Wildlife Services, Riverdale, Maryland.

USDA. 2009. The 2007 Census of Agriculture: Maine State and County Data. Washington, D.C. 459 pp.

USDA. 2010. Environmental Assessment: Reducing gull damage through an integrated wildlife damage management program in the State of Maine. USDA/APHIS/WS, Augusta, Maine.

USDI. 1979. Mammalian predator damage management for livestock protection in the Western United States. Final Environmental Impact Statement. Washington, D.C. 789 pp.

USFWS. 1991. Predator Control Program: Chincoteague National Wildlife Refuge. Unpublished report. Chincoteague, Virginia.

USFWS. 1996. Piping Plover(*Charadrius melodus*) Atlantic Coast Population, Revised Recovery Plan. Hadley, Massachusetts. 258 pp.

USFWS. 1998. Roseate Tern Recovery Plan – Northeastern Population, First Update. Hadley, Massachusetts. 75 pp.

USFWS. 2000. Bird conservation region descriptions. North American Bird Conservation Initiative. U.S. NABCI Committee. 44 pp.

USFWS. 2001*a*. Mammals (brochure). Rachel Carson National Wildlife Refuge. Wells, Maine. Information obtained from website: http://www.fws.gov/northeast/rachelcarson/pdf/mammals.pdf

USFWS. 2001*b*. Inside Region 3: Ohio man to pay more than $11,000 for poisoning migratory birds. Volume 4(2):5.

USFWS. 2007. Rachel Carson National Wildlife Refuge, Comprehensive Conservation Plan and Environmental Assessment. Hadley, Massachusetts.

USFWS. 2008*a*. Environmental Assessment: Laughing Gull Management Plan for Seabird Restoration Islands in Maine. Rockland, Maine.

USFWS. 2009. Piping Plover, Five-Year Review: Summary and Evaluation. http://www.fws.gov/northeast/endangered/PDF/Piping_Plover_five_year_review_and_summary.pdf. Accessed on February 17, 2011.

USFWS. 2011*a*. Piping Plover, Atlantic Coast Population: Overview of biology and Threats. Information obtained from website: http://www.fws.gov/northeast/pipingplover/overview.html. Accessed on February 17, 2011.

USFWS. 2011*b*. Rachel Carson National Wildlife Refuge: Management. Wells, Maine. Information obtained from website: http://www.fws.gov/northeast/rachelcarson/management.html. Accessed on February 17, 2011.

VanDruff, L.W. 1971. The ecology of the raccoon and opossum, with emphasis on their role as waterfowl nest predators. Ph.D. thesis, Cornell University, Ithaca, New York.

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.

Verts, B. J. 1963. Movements and populations of opossums in a cultivated area. J. Wildl. Mgmt. 27:127129.

Viksne, J. 1997. Predation control: Pp 89-94 *in* J. Viksne ed., The Bird Lake Engure. Jana Seta, Riga, Latvia.

Voigt, D. R. 1987. Red fox. Pp 378-392 in M. Novak, J. A. Baker, M.E. Obbard, B. Mallock, eds., Wild Furbearer Management and Conservation in North America. Ministry of Natural Resources, Ontario, Canada. 1150 pp.

Voigt, D. R, and B. D. Earle. 1983. Avoidance of coyotes by red fox families. J. Wildl. Manage. 47:852–857.

Voigt, D. R, and D. W. MacDonald. 1984. Variation in the spatial and social behavior of the red fox, *Vulpes vulpes.* Acta Zool. Fenn. 171:261-265.

Voigt, D. R, and R. L. Tinline. 1980. Strategies for analyzing radio tracking data. Pp 387–404 *in* C. J. Amlaner, Jr., and D. W. Macdonald, eds., A handbook on biotelemetry and radio tracking. Pergamon Press, Oxford, United Kingdom.

Voigt, D. R, and W. E. Berg. 1987. Coyote. Pp 345-357 *in* M. Novak, J. A. Baker, M.E. Obbard, B. Mallock, eds., Wild Furbearer Management and Conservation in North America. Ministry of Natural Resources, Ontario, Canada. 1150 pp.

Wade, P. R. 1998. Calculating limits to the allowable human-caused mortality of cetaceans and pinnipeds. Marine Mammals Science 14:1-37.

Warkentin, I. G., N. S. Sodhi, R. H. M. Espie, A. F. Poole, L. W. Oliphant and P. C. James. 2005. Merlin (*Falco columbarius*). 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/044.

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.

Whitaker, J. O., Jr. and W.L. J. Hamilton, Jr. 1998. Mammals of the Eastern United States. Cornell University Press, Ithaca, New York. 583 pp.

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.

Williams, D. E., and R. M. Corrigan. 1994. Chipmunks. Pp B13-B16 in S. E. Hygnstrom, R. M. Timm and G. E. Larson, eds. Prevention and control of wildlife damage. University of Nebraska-Lincoln, Lincoln, Nebraska.

Windberg, L.A., and F.F. Knowlton. 1988. Management implications of coyote spacing patterns in southern Texas. Journal of Wildlife Management 52:632-640.

Wiseman, G. L., and G. O. Hendrickson. 1950. Notes on the life history and ecology of the opossum in Southeast Iowa. Journal of Mammalogy. 31:331-337.

Witmer, G. W., J. L. Bucknall, T. H. Fritts, and D. G. Moreno. 1996. Predator management to protect endangered avian species. Trans. 61st No. Amer. Wildl. And Natur. Resourc. Conf. 61:102-108.

Wittenberger, J. F., and Hunt, G. L. 1985. The adaptive significance of coloniality in birds. Pages 1-79 i*n* Farner, D. S.; King, J. R. and Parkes, K. C., eds. Avian Biology, no. 8. New York Academic Press.

Yeager, L. E., and R. G. Rennels. 1943. Fur yield and autumn foods of the raccoon in Illinois River bottom lands. J. Wildl. Manage. 7:45–60.

Yerger, R.W. 1953. Home range, territoriality, and populations of the eastern chipmunk in central NewYork. J. Mamm. 34:448-58.

APPENDIX B

METHODS AVAILABLE FOR RESOLVING OR PREVENTING NEST PREDATION IN MAINE

The most effective approach to reducing risks of nest predation would be to integrate the use of several methods, either simultaneously or sequentially. An adaptive plan would integrate and apply practical methods of prevention and reduce predation risks by wildlife while minimizing the potential effects of those methods.

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

A variety of methods would potentially be available to the WS program in Maine and to other entities relative to the management or reduction of predation risks. Various federal, state, and local statutes and regulations, including WS' directives, would govern WS' use of methods. WS would develop and then recommend or implement strategies based on each request for assistance. Within each approach there may be available a number of specific methods or techniques. The following methods could be recommended or used by the WS program in Maine. Many of the methods described would also be available to other entities in the absence of any involvement by WS.

HABITAT MANAGEMENT METHODS

State and federal wildlife and resource managers and property owner practices consist primarily of non-lethal preventive methods, such as managing habitat on property they own or manage. Habitat modification techniques would be implemented by state and federal wildlife resource managers or private property owners/managers. Resource managers may be encouraged to use these methods, based on the level of risk, need, and professional judgment on their effectiveness and practicality.

Minor habitat modification can be an integral part of managing damage associated with wildlife. Wildlife production and/or presence can be 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 wildlife species. In most cases, the resource or property owner would be responsible for implementing habitat modifications, and WS would only provide technical assistance on the type of modifications that would likely achieve the desired outcome. Habitat management is most often a primary component of strategies by eliminating feeding, denning, or resting sites.

Probably few habitat modifications could be implemented to reduce predator abundance because many of those species are highly adaptable generalists. Removing anthropomorphic structures may be beneficial, such as eliminating bird perches and mammal denning structures (*e.g.*, brush piles). However, other types of habitat modification such as the elimination of dense vegetation could be harmful to other wildlife species or affect plant communities on the islands and may lead to erosion of fragile coastal islands. The habitat modifications recommended by WS would be minor modifications that would not reach a magnitude where adverse effects would occur. Habitat modification would not be employed over large geographical areas or applied at such intensity that essential resources (*e.g.*, food sources) would be unavailable for extended durations or over a wide geographical scope that long-term adverse effects

would occur to a species' population.

MECHANICAL MANAGEMENT METHODS – NON-LETHAL

Animal behavior modification refers to tactics that deter or repel predators and thus, reduce predation. 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 at dispersing wildlife. However, those methods are usually effective for only a short time before birds and mammals become accustomed and learn to ignore them (Arhart 1972, Rossbach 1975, Conover 1982, Pfeifer and Goos 1982, Shirota and Masake 1983, Schmidt and Johnson 1984, Mott 1985, Graves and Andelt 1987, Bomford 1990). Devices used to modify behavior in wildlife may include propane exploders, pyrotechnics, distress calls, repellents, scarecrows, mylar tape, eye-spot balloons, lasers, effigies (taxidermy mounts and carcasses), noise associated with the discharge of a firearm, and pursuit with ATVs or vehicles.

Predator-resistant fences are woven wire, welded wire, smooth wire, or electric fences. Woven wire fences generally are four-foot tall and may have a barbed wire along the bottom of the fence to deter digging under by predators. Electric fences may be less expensive to erect but red fox, and other wildlife can pass through electric fences (Greenwood et al. 1990). Avian predators can fly over predator resistant or electric fencing. Electric fences must be maintained and tested regularly. Vegetation and fallen branches on the fence drain current, thus reducing efficacy. In addition, dry soil conditions prevent grounding, and thus the animal can pass through the fence without being shocked (McKillop and Sibly 1988). Trottier et al. (1994) and Greenwood et al. (1990) found predator resistant fencing can separate broods from their hens. Pietz and Krapu (1994) found predator-resistant fencing delays ducklings getting to water and may result in duckling mortality or separation from the hen. Predator-resistant electric fences currently cost approximately $1,500/hectare to enclose nesting areas.

Nest Exclosures are wire fencing placed around a nest to deter avian and mammalian predators. Nest exclosures have reduced predation on eggs and incubating hens resulting in a greater percentage nests hatching eggs (Sargeant et al. 1974, Lokemoen et al. 1982, Greenwood et al. 1990, Melvin et al. 1992). However, nest exclosures only reduce predation on exclosed nests versus unprotected nests; they do not stop nest predation (Sargeant et al. 1974, Greenwood et al. 1990, LaGrange et al. 1995, Melvin et al. 1992). Harassment of incubating adults by raccoons and fox can result in nest abandonment or predation. Chicks that hatch are still vulnerable to avian and mammalian predation once they leave the exclosure to feed. Nest exclosures failed to stop avian (*e.g.*, fish crow) or mammalian (*e.g.*, red fox) predation on eggs or fledglings, or to stop nest abandonment by piping plovers (USFWS 1991). In fact, red fox visitation to nest enclosures increased each year (USFWS 1991).

Temporary fencing is placing temporary electric polytape fence in a nesting or fledgling feeding area to deter predation for a day to a week or more while the immature native birds grow and mature (Mayer and Ryan 1991). The temporary fence may need to be moved daily as the birds may move to new areas to meet nutritional needs.

Auditory scaring devices such as propane exploders, pyrotechnics, electronic guards, scarecrows, shooting in the air, 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 before birds become accustomed and learn to ignore them (Arhart 1972, Rossbach 1975, Shirota and Masake 1983, Schmidt and Johnson 1984, Mott 1985, Bomford and O'Brien 1990, Booth 1994). Birds, too, quickly learn to ignore scaring devices if the birds' fear of the methods is not reinforced with other tactics. These techniques can also frighten protected birds.

Repellents are usually naturally occurring substances or chemicals formulated to be distasteful or to elicit pain or discomfort for target animals when they are smelled, tasted, or contacted. Only a few repellents are commercially available for mammals, and are registered for only a few species. Repellents are not available for many species, which may present damage problems, such as some predators or furbearing species. There are more repellents available for birds. Repellents are variably effective and depend largely on resource to be protected, time and length of application, and sensitivity of the species causing damage. Again, acceptable levels of damage control are usually not realized unless repellents are used in conjunction with other techniques.

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, 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 other tactics.

Effigies can be used to disperse gulls (Avery et al. 2002, Tillman et al. 2002, Seaman et al. 2007) and crows (Chipman et al. 2004). Effigies can be dead gulls/crows or taxidermy gulls/crows (Humphrey et al. 2001, Avery et al. 2002, Tillman et al. 2002, Chipman et al. 2004). Effigies are hung upside down as high as possible in trees or from specially constructed masts to disperse gulls (Humphrey et al. 2001, Tillman et al. 2002, Chipman et al. 2004). A migratory bird permit is required from the USFWS before a gull may be taken to use as an effigy or to salvage a dead gull (*e.g*., road kill) to use as an effigy.

Lasers are non-chemical, non-lethal technique recently evaluated by the National Wildlife Research Center to disperse double-crested cormorants and other birds. 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 individuals and small numbers of birds, although the effective range of the laser is much diminished. Moving the laser light through the tree branches rather than touching birds with the laser light elicited an avoidance response from cormorants (Glahn et al. 2000). During pen trials with lasers, the cormorants were inconsistent in their response with some birds showing no response to the laser (Glahn et al. 2000). The lack of overt response by cormorants to lasers is not clearly understood, but suggests laser light is not a highly aversive agent (Glahn et al. 2000). Blackwell et al. (2002) tested lasers on several bird species and observed varied results among species. Lasers were ineffective at dispersing starlings and cowbirds (Blackwell et al. 2002). Lasers were initially effective at dispersing pigeons and mallard ducks but the birds habituated in approximately 5-minutes and 20-minutes, respectively (Blackwell et al. 2002). Canada geese reacted to the laser displaying neophobic avoidance to the approaching laser beam.

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. 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 are methods of suppressing reproduction in local nuisance bird populations by destroying egg embryos prior to hatching. Egg addling is conducted by vigorously shaking an egg numerous times, which causes detachment of the embryo from the egg sac. Egg destruction can be accomplished in several different ways, but the most commonly used methods are manually gathering eggs and breaking them, or by oiling or spraying the eggs with a liquid, which covers the entire egg and prevents the egg from obtaining oxygen (see *Egg oiling* below).

Live traps include:

Live/Decoy traps are used by WS for preventive and corrective bird damage management. Active traps are monitored daily, every other day, or as appropriate, to remove and euthanize or release trapped birds and to replenish bait and water. Bird traps and other 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. Live or decoy traps can catch single or multiple birds at one time.

Foothold traps can be utilized to live-capture a variety of mammals, but are most often used within Maine to capture coyotes, gray foxes, and red foxes. Three advantages of the foothold trap are: 1) they can be set under a wide variety of conditions, and 2) pan-tension devices can be used to reduce the probability of capturing smaller non-target animals (Turkowski et al. 1984, Phillips and Gruver 1996), and 3) non-target wildlife can be released. Effective trap placement and the use of appropriate lures by trained WS personnel also contribute to the foothold trap's selectivity. Under the proposed action, target animals live-captured in foothold traps would be euthanized.

Foothold traps are difficult to keep operational during inclement weather and they lack selectivity where non-target species are of a similar or heavier weight than the target species. The use of foothold traps also requires more time and labor than some methods, but they are indispensable in resolving many depredation problems.

Foothold traps are constantly being modified and tested to improve animal welfare of captured animals. In 1996, the Association of Fish and Wildlife Agencies began an historic research program to develop Best Management Practices (BMP) for trapping devices. The program aims to improve and modernize the technology of trapping through research that evaluates animal welfare, identifies efficient tools and techniques; and develops recommendations for state fish and wildlife agencies to consider as an element of their management programs. To date, 17 BMPs have been produced. All foothold traps used in the Maine WS program would comply with BMP standards. The foothold traps identified and used in the Maine program include the use of Woodstream Victor Number 3 padded-jaw coil spring for coyotes, and Woodstream Victor Number 1.5 padded-jaw coil spring for foxes. Other possible traps such as, but not limited to the MB450 and the MB550-RC may also be used. As new foot-hold traps are developed, WS may test and use these traps during activities.

Specialized raccoon foot traps are traps designed specifically to capture raccoons. These traps (*e.g.*, Coon Cuffs, Little Griz) are baited, specialized foot traps that are placed into the ground. The trap consists of a small box or tube measuring about 3 – 3 1/2 inches square. There is a small hole about 1 ¼ inches in diameter that a raccoon places its paw into to grab the fish or sweet bait. The specialized trap captures the raccoon's foot when it pulls a lever holding the food. These traps are highly selective and humane for capturing raccoons and opossums. Captured raccoons and opossums would be euthanized.

Cage or box traps, typically constructed of wire mesh, are commonly used to capture raccoons, skunks, cats, and opossums, and possibly used to capture mink, weasels, squirrels, or dogs. Cage traps pose minimal risks to humans, pets, and non-target wildlife and allow for on-site release or relocation of pets and non-target animals. Cage traps, however, cannot be used effectively to capture wary predators such as foxes or coyotes. Active traps are monitored at least once per day to remove and euthanize or release trapped mammals and to replenish bait. Under the proposed action, all target animals except dogs and cats that are live-captured in cage or box traps would be

euthanized.

Cable devices (also known as snares) may be used as either lethal or live-capture devices. They are placed wherever an animal moves through a restricted area (*e.g.*, crawl holes under fences, trails through vegetation) and are easier to keep operational during periods of inclement weather than foothold traps. Careful attention to details when placing cable devices can result in avoiding non-target captures. Maine WS is not currently allowed to use cable devices per MDIFW policy, but could use them on federally owned land, although none have been used to date. In the future, WS expects that non-lethal (restraining) cable devices will be approved by MDIFW for use by WS. These devices have been scientifically evaluated as live-capture devices and meet the criteria of Best Management Practices for Trapping in the United States (Association of Fish and Wildlife Agencies 2006). Target animals live-captured in restraining cables would be euthanized, while non-targets would be released.

Raptor traps consist of bal-chatri, Swedish goshawk, and pole traps. Bal-chatri traps are a wire mesh cage that holds a live rodent or bird for bait, and is covered in slipknot loops made of monofilament fishing line. The Swedish goshawk trap is a much larger cage type trap that holds live bait and has spring-loaded doors. Pole traps are essentially a weak foothold trap that is placed on top of pole or post and allows a trapped raptor to slide down a wire to the ground once captured. Raptor traps are typically only used after predation by a raptor has occurred or if a raptor is routinely observed in a nesting area.

Net traps are designed to capture a variety of bird species, and can be constructed in numerous ways, or may be commercially manufactured (*e.g.*, bow net, rocket net, tub net launcher). In general, net traps rely on birds to be attracted to a specific area, then a net to be dropped or thrown by a remote system. These systems usually require direct observation and engagement of the trap by a human observer.

Trap monitors are devices that send a radio signal to a receiver if a set trap is disturbed and alerts field personnel that an animal may be captured. Trap monitors can be attached directly to the trap or attached to a string or wire and then placed away from the trap in a tree or shrub. When the monitor is hung above the ground, it can be detected from several miles away, depending on the terrain in the area. There are many benefits to using trap monitors, such as saving considerable time when checking traps, decreasing fuel usage, prioritizing trap checks, and decreasing the need for human presence in the area. Trap monitors could be used when using traps.

Trap monitoring devices would be employed, when applicable, that indicate when a trap has been activated. Trap monitoring devices would allow personnel to prioritize trap checks and decrease the amount of time required to check traps, which decreases the amount of time captured target or non-targets would be restrained. By reducing the amount of time targets and non-targets are restrained, pain and stress can be minimized and captured wildlife can be addressed in a timely manner, which could allow non-targets to be released unharmed. Trap monitoring devices could be employed where applicable to facilitate monitoring of the status of traps in remote locations to ensure any captured wildlife was removed promptly to minimize distress and to increase the likelihood non-targets could be released unharmed.

Hunting dogs are sometimes trained and used to hunt for raccoon, coyotes, or red fox. Trained dogs could be an important tool for locating red fox, coyote, or raccoon sign (tracks, hair, or droppings), or to locate dens of these species.

MECHANICAL MANAGEMENT METHODS – LETHAL

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 or rifles (commonly .22 calibers). 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 nonlethal methods. Removal of a few birds from a local population increases the efficacy of harassment programs and prevents habituation to harassment (Kadlec 1968). Shooting can be relatively expensive because of the staff hours sometimes required. Shooting with shotguns 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 activities and all laws and regulations governing the lawful use of firearms are strictly complied with.

Many mammalian predators are nocturnal animals (especially foxes, coyotes, raccoons, and opossums). They may be illuminated at night with spotlights or found with thermal imagers, and then shot with rifles or shotguns as they move about nesting areas. These species may also be called with predator calls imitating injured prey animals and shot when they come within rifle or shotgun range.

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 Domestic Confiscation Law which prohibits firearm possession by anyone who has been convicted of a misdemeanor crime of domestic violence.

Cervical dislocation is sometimes used to euthanize birds that are captured by hand or 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 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).

Denning is the practice of finding red fox, coyote, or striped skunk dens and eliminating the young, adults, or both to stop an ongoing predation problem or prevent future depredation. Denning has been documented to have a highly cost-effective and efficacious in resolving predation problems due to coyotes killing lambs in the spring (Till and Knowlton 1983). Red fox predation on wildlife often increases in the spring and early summer due to the increased food requirements associated with feeding and rearing litters of pups. Pups are typically euthanized in the den using a registered gas fumigant cartridge (see discussion of gas cartridge under *Chemical Management Methods*). Red fox dens are occasionally found on or near nesting beaches in Maine. It is highly probable that striped skunks or coyotes could create burrow dens in these areas as well.

Body gripping (*e.g.*, Conibear) traps are traps designed to cause the quick death of the animal that activates the trap. The appropriate size trap would be used for the target species. These traps would be placed in travel corridors, or feeding areas of the target species. Body gripping traps are most commonly used for mink, and may be set in mink trails or used in conjunction with bait. Safety hazards and risks to humans are usually related to setting, placing, checking, or removing the traps.

Weasel Boxes/Snap Traps are used to target long-tailed weasels, short-tailed weasels, and chipmunks. These traps consist of either a home-made wooden box (6"x5.5"x18") or plastic bait station box (3.5"x8"x13") (Liphatech Inc., Milwaukee, WI) that is used to hold common rat-sized snap traps and limit the entry of larger animals by using an entrance hole of 2.2" or less. Rat-sized snap traps are designed to quickly and humanely kill the target animals and meet BMP criteria for trapping weasels. In some cases, snap traps may be used separate from weasel boxes depending on the site characteristics.

Sport hunting and regulated trapping can be of a strategy to reduce local predator populations near nesting areas. Although WS does not use sport hunting and regulated trapping, it recommends, where appropriate, sport hunting and regulated trapping to alleviate predator damage. Hunters and trappers can provide a societal benefit by reducing local wild animal populations, which can reduce damage. Many nest predators are classified as furbearer species in Maine and may be hunted and trapped. Maine hunting and trapping seasons vary by species, location, and method. A hunting license is required to hunt legal species, and a trapping license is required to trap furbearing animals. There are some exceptions to license requirements for landowners. The MDIFW has specific regulations on license requirements.

All animals that are lethally removed during activities will be disposed of according to federal, state, and local laws and ordinances. As a SOP, WS disposes of animals by either deep burial or incineration and are further defined by WS Directives 2.510 and 2.515.

CHEMICAL MANAGEMENT METHODS

All chemicals used by WS to protect nesting shorebirds and seabirds are registered under the FIFRA and administered by the EPA and Maine Board of Pesticides Control (MBPC). All WS personnel in Maine that use pesticides are certified as restricted-use pesticide applicators by the MBPC; the MBPC requires pesticide applicators to adhere to all certification requirements set forth in the FIFRA.

CHEMICAL MANAGEMENT METHODS – NONLETHAL

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

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

Mesurol, may be used only by WS personnel. Treated areas will be posted with warning signs at access points to exclude people from endangered or threatened species nesting areas. Treated eggs are not placed in locations where threatened or endangered species may eat the treated eggs. Mesurol is highly toxic to birds and mammals and toxic to fish. It is also highly toxic to honey bees.

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 nonlethal in that a small

portion of the birds are generally killed (Johnson and Glahn 1994). Pre-baiting is usually necessary to achieve effective bait acceptance by the target species. This chemical is registered for use on pigeons, crows, gulls, blackbirds (grackles), starlings, and English sparrows in various situations. Avitrol® treated bait is placed in an area where the targeted birds are feeding and usually a few birds will consume a treated bait and become affected by the chemical. The affected birds then broadcast distress vocalizations and display abnormal flying behavior, thereby frightening the remaining flock away.

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

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

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.

Ketamine (Ketamine HCl) is a dissociative anesthetic that is used to capture wildlife, primarily mammals, birds, and reptiles. It is used to eliminate pain, calms fear, and allay anxiety. Ketamine is possibly the most versatile drug for chemical capture, and it has a wide safety margin (Fowler and Miller 1999). When used alone, this drug may produce muscle tension, resulting in shaking, staring, increased body heat, and, on occasion, seizures. Usually, ketamine is combined with other drugs such as xylazine. The combination of such drugs is used to control an animal, maximize the reduction of stress and pain, and increase human and animal safety.

Xylazine is a sedative (analgesic) that calms nervousness, irritability, and excitement, usually by depressing the central nervous system. Xylazine is commonly used with ketamine to produce a relaxed anesthesia. It can also be used alone to facilitate physical restraint. Because xylazine is not an anesthetic, sedated animals are usually responsive to stimuli. Therefore, personnel should be even more attentive to minimizing sight, sound, and touch. When using ketamine/xylazine combinations, xylazine will usually overcome the tension produced by ketamine, resulting in a relaxed, anesthetized animal (Fowler and

Miller 1999). This reduces heat production from muscle tension, but can lead to lower body temperatures when working in cold conditions.

Telazol (tiletamine) is another anesthetic used in wildlife capture. It is 2.5 to 5 times more potent than ketamine; therefore, it generally works faster and lasts longer. Currently, tiletamine can only be purchased as Telazol, which is a mixture of two drugs: tiletamine and zolazepam (a tranquilizer). Muscle tension varies with species. Telazol produces extensive muscle tension in dogs, but produces a more relaxed anesthesia in coyotes, wolves, and bears. It is often the drug of choice for those wild species (Fowler and Miller 1999). This drug is sold in a powder form and must be reconstituted with sterile water before use. Once mixed with sterile water, the shelf life is four days at room temperature and 14 days if refrigerated.

CHEMICAL MANAGEMENT METHODS - LETHAL

The **Gas Cartridge** is registered as a fumigant by the EPA (Reg. No. 56228-21) and is used in conjunction with denning operations in Maine to target red fox, striped skunks, and coyotes. When ignited, the cartridge burns in the den of an animal and produces large amounts of carbon monoxide, a colorless, odorless, and tasteless, poisonous gas. The combination of oxygen depletion and carbon monoxide exposure kills the animals in the den. Sodium nitrate is the principle active chemical in gas cartridges, is a naturally occurring substance. Although stable under dry conditions, it is readily soluble in water and likely to be highly mobile in soils. In addition, dissolved nitrate is very mobile, moving quickly through the vadose zone to the underlying water table (Bouwer 1989). Burning sodium nitrate however, as in the use of a gas cartridge as a fumigant in a rodent burrow, is believed to produce mostly simple organic and inorganic gases, using all of the available sodium nitrate. In addition, the human health drinking water tolerance level for this chemical is 10 mg / L, a relatively large amount, according to EPA Quality Criteria for Water (EPA 1986*a*, EPA 1986*b*). The gas along with other components of the cartridge, are likely to form oxides of nitrogen, carbon, phosphorus, and sulfur. These products are environmentally non-persistent because they are likely to be metabolized by soil microorganisms or enter their respective elemental cycles. In rodent cartridges, sodium nitrate is combined with seven additional ingredients; sulfur, charcoal, red phosphorus, mineral oil, sawdust, and two inert ingredients. None of the additional ingredients in this formulation are likely to accumulate in soil, based on their degradation into simpler elements by burning the gas cartridge. Sodium nitrate is not expected to accumulate in soils between applications, nor does it accumulate in the tissues of target animals (EPA 1991).

Carbon Dioxide (CO_2) is sometimes used to euthanize birds and mammals that are captured in live traps and/or nets. Animals 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 American Veterinary Medical Association (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 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.

Sodium Pentobarbital is a barbiturate that rapidly depresses the central nervous system to the point of respiratory arrest. There are DEA restrictions on who can possess and administer this drug. Some states may have additional requirements for personnel training and particular sodium pentobarbital products available for use in wildlife. Certified WS personnel are authorized to use sodium pentobarbital and dilutions for euthanasia in accordance with DEA and state regulations.

Potassium Chloride used in conjunction with prior general anesthesia is used as a euthanasia agent for animals, and is considered acceptable and humane by the AVMA (AVMA 2007). Animals that have been

euthanized with this chemical experience cardiac arrest followed by death, and are not toxic to predators or scavengers.

Beuthanasia-D combines pentobarbital with another substance to hasten cardiac arrest. Intravenous (IV) and intracardiac (IC) are the only acceptable routes of injection. As with pure sodium pentobarbital, IC injections with Beuthanasia-D are only acceptable for animals that are unconscious or deeply anesthetized. With other injection routes, there are concerns that the cardiotoxic properties may cause cardiac arrest before the animal is fully unconscious. It is a Schedule III drug, which means it can be obtained directly from the manufacturer by anyone with a DEA registration. However, Schedule III drugs are subject to the same security and record-keeping requirements as Schedule II drugs.

DRC-1339 is the principal chemical method that would be used for crow and gull damage management under the proposed action. For more than 30 years, DRC-1339 has proven to be an effective method of starling, blackbird, gull, and pigeon management at feedlots, dairies, airports, and in urban areas (Decino et al. 1966, Besser et al. 1967, West et al. 1967, Nisbet 1989, Blodget and Henze 1992, Megyesi 1998). Studies continue to document the effectiveness of DRC-1339 in reducing gull abundance to benefit threatened or endangered shorebirds or colonial waterbirds (Nisbet 1989, Blodget and Henze 1992, Megyesi 1998), resolving blackbird/starling problems at feedlots (West and Besser 1976, Glahn 1982, Glahn et al. 1987), dispersing crows roosts in urban/suburban areas (Boyd and Hall 1987), and Blanton et al. (1992) reports that DRC-1339 appears to be a very effective, selective, and safe means of urban pigeon population reduction. Glahn and Wilson (1992) noted that baiting with DRC-1339 is a cost-effective method of reducing damage by blackbirds to sprouting rice.

DRC-1339 is a slow acting avicide that is registered with the EPA for reducing damage from several species of birds, including blackbirds, starlings, pigeons, crows, ravens, magpies, and gulls. DRC-1339 was developed as an avicide because of its differential toxicity to mammals. DRC-1339 is highly toxic to sensitive species but only slightly toxic to non-sensitive birds, predatory birds, and mammals (Johnson et al. 1999, Schafer, Jr. 1981, Schafer, Jr. 1991). 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, 56228-17, 56228-28, 56228-29, and 56228-30) depending on the application or species involved in the bird damage management project. Maine WS has used an average of 149.23 grams of DRC-1339 per year for the past 3 years (see Table B-1). Only WS' personnel are authorized to use DRC-1339 in Maine.

Table B-1. DRC-1339 Used by Maine WS from FY 2009 to FY 2011.

FY	EPA Reg.	Species	Quantity Used (grams)
2009	56228-10	Blackbirds/Starlings	189.75
	56228-28	Pigeons	55.55
	56228-17	Gulls	1.0
2010	56228-10	Blackbirds/Starlings	34.5
	56228-28	Pigeons	10.63
	56228-17	Gulls	0
2011	56228-10	Blackbirds/Starlings	126.5
	56228-28	Pigeons	29.76
	56228-17	Gulls	0

APPENDIX C

THE NUMBER AND LOCATIONS OF NESTING PIPING PLOVERS IN MAINE 1981-2011.

	OGUNQUIT	MOODY	WELLS	DRAKES ISLAND	LAUDHOLM FARM	CRESCENT SURF	PARSONS BEACH	MARSHALL POINT	GOOSE ROCKS	FORTUNES ROCK	HILLS BEACH	FERRY	GOOSEFARE BROOK	OLD ORCHARD	PINE POINT	WESTERN	SCARBOROUGH	HIGGINS	RAM ISLAND	CRESCENT	HEAD BEACH	SEAWALL	POPHAM	HUNNEWELL	INDIAN POINT	REID STATE PARK	TOTAL
1981	0	0	1(0)	-	-	4(9)	-	0(0)	1(0)	-		-	-	-	1(0)	-	-	-	-	-		2(0)	0(0)	-	-	1(0)	**10(9)**
1982	0	0	0	-	-	3(10)	-	0	0	-		-	-	-	1(0)	-	-	-	-	-		5(8)	3(0)	-	-	1(0)	**10(18)**
1983	0	0	0	-	-	1(0)	-	0	0	-		-	-	-	0	-	-	-	-	-		3(4)	1(0)	-	-	1(3)	**6(7)**
1984	0	0	0	-	-	0	-	0	0	-		-	-	-	0	-	-	-	-	-		6(14)	1(2)	-	-	2(5)	**9(21)**
1985	1(3)	0	0	-	-	1(0)	-	1(2)	1(3)	-		-	-	-	0	-	-	-	-	-		9(14)	0	-	-	2(6)	**15(28)**
1986	1(1)	0	0	-	0	1(0)	-	0	1(4)	-		-	-	-	0	0	-	-	0	-		9(24)	0	0	-	3(2)	**15(31)**
1987	[1(0)]	0	0	-	0	1(0)	-	0	1(4)	-		-	-	-	1(0)	0	-	-	0	-		8(17)	0	0	-	1(0)	**12(21)**
1988	[1(0)]	0	0	-	0	1(2)	-	0	2(3)	-		-	-	-	0	0	-	-	0	-		7(3)	1(3)	6(2)	-	3(0)	**20(15)**
1989	0	0	0	-	0	2(3)	-	0	2(8)	-		-	-	-	0	0	-	-	0	-		7(11)	3(11)	1(3)	-	1(2)	**16(38)**
1990	0	0	0	-	0	3(4)	-	0	2(4)	-		-	-	-	0	0	-	-	0	-		6(8)	3(2)	1(4)	-	2(4)	**17(26)**
1991	0	0	0	-	1(3)	3(9)	-	0	1(3)	-		-	-	-	1(0)	-	-	-	-	-		4(12)	4(6)	2(6)	-	2(6)	**18(45)**
1992	0	0	0	-	1(0)	4(16)	-	0	2(3)	-		-	-	-	0	1(2)	-	-	-	-		7(13)	5(10)	2(0)	-	2(5)	**24(49)**
1993	0	0	0	-	1(4)	4(16)	-	0	2(7)	-		-	1(2)	-	0	3(9)	-	2(2)	1(3)	-		6(10)	8(18)	1(0)	-	3(5)	**32(76)**
1994	0	0	0	-	1(3)	4(11)	-	0	4(10)	-		-	1(3)	0	2(1)	3(8)	-	2(2)	1(1)	-		5(6)	7(19)	1(0)	-	4(6)	**35(70)**
1995	2(5)	0	2(5)	-	1(2)*	4(9)	-	0	6(15)	1(2)		-	1(0)	0	[1(0)]	3(10)	1(3)	2(4)*	2(5)	-		6(12)	4(12)	0	-	5(11)	**40(95)**
1996	5(10)	0	4(12)	1(0)	1(4)	5(15)	-	1(3)	6(8)	2(3)*		-	1(2)	1(3)	3(0)	3(4)	2(0)	5(13)	1(3)	-		7(6)	5(10)*	0	-	7(2)	**60(98)**
1997	3(8)	0	4(11)	-	1(2)	4(13)	-	1(3)	6(13)	2(4)		-	1(0)	2(0)	1(0)	[1(0)]	2(1)	4(13)	1(4)	-		5(9)	6(11)	-	[1(0)]	4(1)	**47(93)**
1998	6(16)	0	4(5)	1(0)	2(3)	3(6)	-	1(0)	7(14)	3(10)		-	1(1)	0(0)	1(0)	1(2)	3(2)	4(3)	2(4)	1(1)		9(10)	5(6)	2(2)	0	4(3)	**60(88)**
1999	6(5)	1(2)	6(9)	0	4(11)	4(4)	-	0(0)	6(12)	4(7)		1(1)	0(0)	0(0)	0(0)	0(0)	2(4)	3(10)	3(6)	1(1)		8(10)	2(3)	3(3)	0	2(3)	**56(91)**
2000	4(4)	0	5(10)	0	6(14)	3(6)	1(4)	0	5(1)	3(3)		0	1(4)	0	0	0	3(8)	2(7)	2(7)	1(0)		9(7)	0	2(1)	0	3(4)	**50(80)**
2001	3(1)	0	6(19)	0	4(14)	5(14)^	1(4)	0	4(11)	4(0)		0	1(1)	1(2)	1(0)	0	3(6)	4(9)	4(5)	0		10(8)	[1(0)]	1(4)	1(3)	4(8)^	**55(109)**
2002	5(0)	0(0)	7(10)	1(0)	5(15)	5(6)	2(7)	0(0)	4(9)	3(1)	1(1)	0(0)	1(1)	1(1)	4(1)	0(0)	4(4)	4(11)	4(5)	1(1)	1(0)	6(9)	1(0)	0(0)	0(0)	6(9)	**66(91)**
2003	3(1)	0(0)	5(12)	1(1)	6(10)	8(0)	3(6)	0(0)	4(5)	1(2)	1(0)	0(0)	1(4)	1(1)	2(2)	0(0)	3(1)	5(10)	3(1)	1(0)	0(0)	5(3)	1(0)	0(0)	0(0)	7(19)	**61(78)**
2004	3(4)	0(0)	7(21)	1(0)	5(3)	3(4)	2(3)	0(0)	4(0)	1(3)	1(2)	0(0)	1(1)	1(2)	1(0)	0(0)	2(1)	6(10)	3(5)	1(0)	0(0)	5(7)	1(1)	0(0)	0(0)	7(13)	**55(80)**
2005	4(0)	0	6(6)	1(0)	1(1)	6(5)	1(0)^	0	1(1)	1(0)	2(1)	0	1(2)	1(0)	0	2(1)	2(6)	6(0)	4(1)	0	0	5(0)	1(0)^	0	0	6(3)	**49(27)**
2006	1(0)	1(2)	4(9)	1(2)	0	5(4)	0	0	5(14)	0	2(1)	0(0)	1(1)	1(1)	0	2(0)	3(6)	3(2)	2(3)	0	0	5(4)	1(2)	0	0	3(3)	**40 (54)**
2007	3(1)	0	2(2)	1(1)	0	4(4)	0	0	7(10)	0	1(0)	2(0)	1(0)	1(2)	0	2(6)	2(0)	2(3)	1(1)	0	0	2(0)	1(0)	0	0	3(7)	**35 (37)**
2008	0	0	2(6)	0	0	3(9)	1(1)	0	7(15)	0	0	0(0)	2(3)	1(0)	0	1(4)	1(0)	1(0)^	3(3)	0	0	0	0	0	0	2(1)	**24(42)**
2009	1(3)	0	2(3)	0	0	6(19)	0	0	8(15)	0	0	0	1(3)	1(0)^	0	1(0)	1(0)^	2(0)	2(2)	0	0	2(0)*	0	0	0	2(1)*	**27 (46)**
2010	2(2)	0	3(6)	0	0	6(14)	0	0	8(10)	2(6)	0	0	1(3)	0	0	1(0)	0	1(2)	2(0)	0	0	0	2(2)	0	0	2(4)	**30(49)**
2011	**3(5)**	**0**	**4(7)**	**0**	**0**	**5(14)**	**1(4)**	**0**	**7(18)**	**2(3)**	**1(0)[1]**	**0**	**1(4)**	**0**	**1(1)**	**0**	**1(0)**	**2(1)**	**1(3)**	**0**	**0**	**1(4)**	**3[2](6)**	**0**	**0**	**1(0)**	33(70)

APPENDIX D

THE NUMBER AND LOCATIONS OF NESTING LEAST TERNS IN MAINE 1977-2011.

Table 1: Number of Nesting Least Tern Pairs and Fledglings ( ) at each Nesting Site in Maine, 1977-2011

	WELLS	LAUDHOLM FARM	CRESCENT SURF	GOOSE ROCKS	GOOSEFARE BROOK	PINE POINT	FERRY/ WESTERN BEACH	STRATTON ISLAND	HIGGINS	RAM ISLAND	SEAWALL	POPHAM	REID STATE PARK	TOTAL
1977	0(0)	[3(0)]	14(10)	20-25(20)	-	0(0)	6-8(6)	-	-	0(0)	13(14)	4-5(0)	0(0)	50-60(50)
1978	0(0)	0(0)	[7(0)]	55(35+)	-	0(0)	20(25+)	-	-	0(0)	18(6+)	0(0)	0(0)	93(66)
1979	25(6+)	3(?)	0(0)	[22(0)]	-	0(0)	30(12)	-	-	0(0)	20(13)	0(0)	0(0)	78(31)
1980	[2(0)]	[6(0)]	17(12)	15(12)	-	0(0)	6(0)	-	-	0(0)	12(4)	0(0)	12(6)	62(34)
1981	0(0)	[N3(0)] [S3(0)]	55(20)	6-15(0)	-	0(0)	0(0)	-	-	0(0)	E2(0) W2(0)	4(1)	15(0)	78(21)
1982	0(0)	0(0)	27(13)	0(0)	-	0(0)	0(0)	-	-	0(0)	E3(5) W4(2)(0)	0(0)	5(6)	39(26)
1983	0(0)	0(0)	[9](0)	22(5)	-	0(0)	0(0)	-	-	0(0)	14(12)	10(5)	8(7+)	54(29)
1984	0(0)	0(0)	0(0)	39(15)	-	0(0)	0(0)	-	-	0(0)	40(52)	0(0)	9(15)	88(82)
1985	0(0)	0(0)	4(3)	57(6)	-	0(0)	0(0)	-	-	8(0)	36(3)	0(0)	26(0)	131(12)
1986	0(0)	0(0)	26(10)	25(1)	-	1(0)	0(0)	-	-	0(0)	72(18)	0(0)	0(0)	124(30)
1987	0(0)	0(0)	[20(0)]	19(2)	-	8(1)	0(0)	-	-	0(0)	48(3)	14(6)	[8(0)]	89(12)
1988	0(0)	0(?)	45(20+)	[12(1)]	-	0(0)	0(0)	-	-	0(0)	13(12)	40+(7+)	[12(0)]	98(40)
1989	0(0)	0(0)	46(0)	5(0)	-	0(0)	0(0)	-	-	0(0)	18(1)	15(1)*	6(6)	83(8)
1990	0(0)	0(0)	16(6)	3(0)	-	0(0)	0(0)	-	-	0(0)	18(2)	20(15)	8(21)	65(44)
1991	0(0)	1(1)	0(0)	9(0)	-	0(0)	0(0)	-	-	0(0)	0*(12)	30(6)	12(6)	52(25)
1992	0(0)	14(11)	15(42)	0(0)	-	0(0)	0(0)	-	-	0(0)	33(30)	0*(0)	32(40)	94(123)
1993	0(0)	1(3)	64(62)	1(0)	-	0(0)	0(0)	-	-	0(0)	29(22)	8(4)	22(23)	125(114)
1994	0(0)	12(13)	35(32)	0	-	0(0)	0	-	-	0	22(20)	0	20(14)	89(79)
1995	0	8(0)	25(9)	[10(0)]	-	0	0	-	-	0	25(0)	0	42(7)	100(16)
1996	0	0	[15(0)]	0	-	0	0	-	15(8)	0	[20(0)]	25(22)	[30(0)]	60(30)
1997	0	0	20(1)	0	-	0	0	-	15(10)	0	[4(0)]	15(0)	[16(0)]	50(11)
1998	0	1(2)	20(7)	10(0)	1(0)	0	0	-	[25(1)]	0	12(2)	0	35(0)	86(12)
1999	0	20(20)	40(45)	0	0	0	0	-	[9(1)][1]	0	[28(1)][1]	0	0	62(67)
2000	0	37(17)	85(62)	0	0	0	0	-	4(2)	0	0	0	0	126(81)
2001	0	15(#)	102(57)	0	0	0	0	-	4(6)[2]	0	3(0)[2]	0	0	120(63)
2002	0	12(√)	81(145)	0	0	0	0	-	9(8)	0	0	0	19(2)	121(155)
2003	0	20(0)	57(8)	8(0)	0	0	0	-	38(53)	0	0	0	33(5)	156(66)
2004	15(10)	1(0)	[50(3)]	0	0	0	0	-	45(54)	0	0	0	50(2)	146(69)
2005	0	4(1)	[52(7)]	0	0	0	[40(3)]	18(9)	[22(0)]	0	[17(0)]	0	0	114(20)
2006	[1(0)]	0	30(10)	[25(1)]	0	0	0	103(15)4		0	0	0	[1(0)]	134(26)5
2007	1(1)	0	[37(1)]	[45(2)]	0	0	0	113(108)	0	0	0	0	0	150(112)6
2008	0	0	30(10)	2(0)	0	0	[2]	72(33)	0	0	0	0	0	166(89)7
2009	0	0	102 (62)	[6(0)]	0	0	0	72 (16)	[16(0)]	0	0	0	0	170 (78)
2010	0	0	136 (22)	18 (0)[8]	0	0	0	76 (3)	0	0	0	0	0	212 (25)
2011	**0**	**0**	**123 (73)**	**23 (12)**	**0**	**0**	**0**	**59 (28)**	**0**	**0**	**0**	**0**	**0**	**205 (113)**

APPENDIX E

THE NUMBER AND LOCATIONS OF NESTING ROSEATE TERNS IN MAINE 1977-2010

	W.goose rocks	Beach Island	Stratton Island	The Nubbin	Clapboard Isl Ledge	Outer Green	Pond Isl (Casco)	Jenny Island	Pond Is NWR (Kennebec)	N. Sugarloaf	Outer Head	Thrumcap I 2	Xmas cve rck	Kilick Stone	Eastern Egg Rock	Brothers Isl (Port Clyde)	Large Green Isl	Metinic (N end)	Matinicus Rock	Seal Isl NWR	Connary Nub	Egg Rock NWR (Frenchman's)	Petit Manan NWR	Nash Isl	Big Nash Isl	total	# sites	sites w/ >50pr	Year
1977		25								35													20			*80*	*3*	*0*	**1977**
1984			1				4			15	2	2	1	1	30							3	9	5	2	*75*	*12*	*0*	**1984**
1987	6						5								2				1				38			*52*	*5*	*0*	**1987**
1988	7		5	2	1									1	5		6						42			*69*	*8*	*0*	**1988**
1989	12	1	2												17								48			*80*	*5*	*0*	**1989**
1990			18											1	38								50			*107*	*4*	*1*	**1990**
1991			14											2	50				5	4			52			*127*	*6*	*2*	**1991**
1992			8												51				1				61			*121*	*4*	*2*	**1992**
1993			7					6							59				3		1		65			*141*	*6*	*2*	**1993**
1994			3					15							63						1		60			*142*	*5*	*2*	**1994**
1995	1		1												86	1				1			61			*151*	*6*	*2*	**1995**
1996			10												126	1							24			*161*	*4*	*1*	**1996**
1997			56					12							138	1				1			29			*237*	*6*	*2*	**1997**
1998			86					8							144								19			*257*	*4*	*2*	**1998**
1999			100					10							149					1			28			*288*	*5*	*2*	**1999**
2000			104												165					1			15			*285*	*4*	*2*	**2000**
2001			127												145					1			16			*289*	*4*	*2*	**2001**
2002			98												160								27			*285*	*3*	*2*	**2002**
2003			40						2						164			3					31			*240*	*5*	*1*	**2003**
2004			11			8		2	9						110			1					29			*170*	*7*	*1*	**2004**
2005			2			36		11	1						136								9			*195*	*6*	*1*	**2005**
2006			84			6		15	1						113			2		1			23			*245*	*8*	*2*	**2006**
2007			79			7		16							118								5			*225*	*5*	*2*	**2007**
2008			67					2							129				1				4			*203*	*5*	*2*	**2008**
2009			76					3							101								4			*184*	*4*	*2*	**2009**
2010			35			15		32	3						82			1	1	2			1			*172*	*9*	*1*	**2010**
Average (pairs/year)	6.50	13.00	43.08	2.00	1.00	14.40	4.50	11.00	3.20	25.00	2.00	2.00	1.00	1.25	95.24	1.00	6.00	1.75	2.00	1.50	1.00	3.00	29.62	5.00	2.00	176.19	5.50	1.40	

APPENDIX F

MDIFW GOALS AND OBJECTIVES FOR THE RECOVERY OF PIPING PLOVERS, LEAST TERNS, AND ROSEATE TERNS

Piping Plover Management Goals And Objectives: 2000 – 2015

Adopted by MDIFW Commissioner and Advisory Council March 30, 2001

Goal: Increase the abundance of piping plovers and the number and quality of nesting sites in Maine.

Population Objective: Increase the number of nesting pairs of piping plovers to at least 80 distributed at all available sites in at least 3 of the prior 5 years by 2015.

Nesting Habitat Objective 1: Maintain nesting, and the integrity of nesting habitat, at the 23 active nesting sites (Table 6 of the Assessment) used by piping plovers between 1997-1999.

Nesting Habitat Objective 2: Increase the number of successful nest sites by 5 in at least 3 of the prior 5 years through 2015.

Nesting Habitat Objective 3: Develop long term, non-regulatory habitat protection via management agreements, conservation easements, or acquisition for 10 nesting sites by 2015.

Productivity Objective: Increase the statewide average annual productivity of piping plovers to 2.0 fledged chicks per nesting female in at least 3 of the prior 5 years through 2015.

Outreach Objective 1: By 2004, develop with partners, an outreach plan containing measurable objectives to increase awareness and promote stewardship of nesting piping plovers in Maine.

Outreach Objective 2: Develop and implement a landowner assistance and recognition program by 2004.

Least Tern Management Goal And Objectives: 2000 – 2015

Adopted by MDIFW Commissioner and Advisory Council March 30, 2001

Goal: Increase the abundance of least terns and the number and quality of nesting sites in Maine.

Population Objective: Increase the number of nesting pairs of least terns to at least 150 distributed over 7 areas (Laudholm Beach, Crescent Surf Beach, Goose Rocks Beach, Higgins Beach, Seawall Beach, Popham Beach, and Reid State Park) in at least 3 of the prior 5 years by 2015.

Nesting Habitat Objective 1**:** Maintain the integrity of the nesting habitat at the 7 areas (see Population Objective) used by least terns in Maine.

Nesting Habitat Objective 2: By 2005, develop long-term management agreements to protect and manage habitat at all current least tern nesting sites in conservation ownership.

Nesting Habitat Objective 3: By 2005, develop long-term, non-regulatory habitat protection and management via management agreements, conservation easements, or acquisition at Goose Rocks and Seawall Beach.

Productivity Objective: Increase the statewide average annual productivity of least terns to 1.0 fledged chick per nesting female in at least 3 of the prior 5 years through 2015.

Outreach Objective 1: By 2004, develop with partners, an outreach plan containing measurable objectives to increase awareness and promote stewardship of nesting least terns in Maine.

Outreach Objective 2: By 2004, develop and implement a landowner assistance and recognition program, especially for landowners at Goose Rocks and Seawall Beach.

Island-nesting Terns Goals and Objectives: 2006 - 2021
Adopted by MDIFW Commissioner and Advisory Council July 11, 2007

Goal: Increase the abundance, expand the distribution, and ensure the long-term viability of all three island-nesting tern species (Common Terns, Arctic Terns, and Roseate Terns) in Maine.

Population Objective 1: By 2021, increase the five-year average populations of all island-nesting tern species to at least 10,000 pairs of Common Terns, 6,000 pairs of Arctic Terns, and 300 pairs of Roseate Terns.

Productivity Objective 1: By 2011, increase or maintain productivity of Roseate Tern colonies to sustain a five-year productivity average of ≥1 fledged chick/pair at 3 core colonies, each of which support more than 50 pairs of Roseate Terns.

Productivity Objective 2: By 2016, increase or maintain productivity of Arctic Tern colonies to sustain a five-year productivity average of ≥1 fledged chick/pair at 3 core colonies, each of which support more than 1,000 pairs of Arctic Terns, and 3 other core colonies, each of which support more than 400 pairs of Arctic Terns.

Productivity Objective 3: By 2016, increase or maintain productivity of Common Tern colonies to sustain a five-year productivity average of ≥1 fledged chick/pair at 4 core colonies, each of which support more than 1,500 pairs of Common Terns, and 6 other core colonies, each of which support more than 500 pairs of Common Terns.

Productivity Objective 4: By 2016, increase the number of minimally managed tern nesting islands to at least 20 islands, each of which sustain a five-year productivity average of ≥0.5 fledged chick/pair.
Distribution Objective 1: By 2011, maintain the current core of nine managed tern colonies, while increasing the number and distribution of productive colonies, to ensure that there is at least one productive colony in each of Maine's eight coastal regions that supports at least 200 pairs of terns. Island-nesting Terns Goals and Objectives 2006 - 2021 Adopted July 11, 2007

Habitat Objective 1: By 2011, identify and conserve a suite of islands in each of Maine's eight coastal regions that have at least a short-term potential of supporting nesting terns.

Habitat Objective 2: By 2011, document and conserve principal island-nesting tern staging and foraging areas.

APPENDIX G

SPECIES THAT ARE FEDERALLY LISTED AS THREATENED OR ENDANGERED IN THE STATE OF MAINE

Animals -- 18 listings

Status	*Species listed in this state and that occur in this state*
E	Beetle, American burying (*Nicrophorus americanus*)
E	Blue, Karner (*Lycaeides Melissa samuelis*)
E	Curlew, Eskimo (*Numenius borealis*)
T	Lynx, Canada (*Lynx Canadensis*)
T	Plover, piping except Great Lakes watershed (*Charadrius melodus*)
E	Puma (=cougar), eastern (*Puma (=Felis) concolor couguar*)
E	Ridley, Atlantic (*Lepidochelys kempi*)
E	Salmon, Atlantic (*Salmo salar*)
E	Sea turtle, leatherback (*Dermochelys coriacea*)
T	Sea turtle, loggerhead (*Caretta caretta*)
E	Sturgeon, shortnose (*Acipenser brevirostrum*)
E	Tern, roseate northeast U.S. nesting pop. (*Sterna dougallii dougallii*)
E	Whale, finback (*Balaenoptera physalus*)
E	Whale, Humpback (*Megaptera novaeangilae*)
E	Whale, northern right (*Balaena glacialis (incl. australis)*)
E	Whale, Sei (*Balaenoptera borealis*)
E	Whale, Sperm (*Physeter catodon*)
E	Wolf, gray (*Canis lupus*)

Plants -- 3 listings

Status	*Species listed in this state and that occur in this state*
E	Lousewort, Furbish's (*Pedicularis furbishiae*)
T	Pogonia, small whorled (*Isotria medeoloides*)
T	Orchid, Prairie white-fringed (*Platanthera leucophaea*)

APPENDIX H

SPECIES THAT ARE STATE LISTED AS THREATENED OR ENDANGERED IN THE STATE OF MAINE

47 Listings

Status	***Birds***
E	Bittern, Least (*Lxobrychus exilis*)
T	Cormorant, Great (*Phalacrocorax carbo*) (Breeding population only)
T	Duck, Harlequin (*Histrionicus histrionicus*)
E	Eagle, Golden (*Aquila chrysaetos*)
E	Falcon, Peregrine (*Falco peregrinus*) breeding population only
T	Goldeneye, Barrow's (*Buchephala islandica*)
T	Heron, Black-crowned Night (*Nycticorax nycticorax*)
T	Moorhen, Common (*Gallinula chloropus*)
T	Owl, Short-eared (*Asio flammeus*) (breeding population only)
E	Pipit, American (*Anthus rubescens*) (breeding population only)
E	Plover, Piping (*Charadrius melodus*)
T	Puffin, Atlantic (*Fratercula arctica*)
T	Razorbill (*Alca torda*)
T	Sandpiper, Upland (*Bartramia longicauda*)
E	Sparrow, Grasshopper (*Ammodramus savannarum*)
T	Tern, Arctic (*Sterna paradisaea*)
E	Tern, Black (*Chilidonias niger*)
E	Tern, Least (*Sterna antillarum*)
E	Tern, Roseate (*Sterna dougallii*)
E	Wren, Sedge (*Cistothorus platensis*)
Status	***Reptiles and Amphibians***
T	Loggerhead (*Caretta caretta*)
E	Racer, Black (*Coluber constrictor*)

E	Turtle, Blandings (*Emys blandingii*)
E	Turtle, Box (*Terrapene Carolina*)
T	Turtle, Spotted (*Clemmys guttata*)
Status	***Mammals***
E	Cottontail, New England (*Sylvilagus transitionalis*)
T	Lemming, Northen Bog (*Synaptomys borealis*)
Status	***Fish***
T	Darter, Swamp (Etheostoma fusiforme)
E	Pickerel, Redfin (*Esox americanus americanus*)
Status	***Mollusks***
T	Floater, Brook (*Alasmidonta varicosa*)
T	Lampmussel, Yellow (*Lampsilis cariosa*)
T	Mucket, Tidewater (*Leptodea ochracea*)
Status	***Insects***
E	Arctic, Katahdin (*Oeneis polixenes katahdin*)
T	Boghaunter, Ringed (*Williamsonia lintneri*)
E	Clubtail, Rapids (*Gomphus quadricolor*)
E	Copper, Clayton's (*Lycaena dorcas claytoni*)
T	Duskywing, Sleepy (*Erynnis brizo*)
T	Fritillary, Purple Lesser (*Boloria chariclea grandis*)
E	Hairstreak, Edwards (*Satyrium edwardsii*)
E	Hairstreak, Hessel's (*Callophrys hesseli*)
E	Hairstreak, Juniper (*Callophrys gryneus*)
E	Mayfly, Roaring Brook (*Epeorus frisoni*)
T	Mayfly, Tomah (*Siphlonisca aerodromia*)
T	Moth, Twilight (*Lycia rachelae*)
T	Snaketail, Boreal (*Ophiogomphus colubrinus*)
T	Snaketail, Pygmy (*Ophiogomphus howei*)

T Zanclognatha, Pine Barrens (*Zanclognatha martha*)

APPENDIX I

USDA APHIS Wildlife Services

Standard Operating Procedures to Safeguard State Threatened and Endangered Species

Introduction:

This plan has been prepared to provide guidance and standard operating procedures for USDA, APHIS, Wildlife Services (WS) employees when conducting official duties relating to wildlife damage management directed at protecting state endangered piping plovers and least terns. The procedures outlined in this protocol have been prepared so that negative effects to state-listed species are minimized or eliminated. Although piping plovers and least terns are the focus of protection from WS' involvement, it is also recognized that state endangered New England cottontails also occupy the habitats that are often adjacent to piping plover and least tern nesting areas. The procedures contained herein will apply specifically to wildlife damage management activities that occur in York and Cumberland Counties where piping plovers and least terns nest. The conditions that are outlined in this document have been mutually agreed upon by the Maine Department of Inland Fisheries and Wildlife to safeguard piping plovers, least terns, and New England cottontails to the highest extent practicable while achieving benefits offered to reduce depredations of piping plovers and least terns.

Piping Plovers and Least Terns:

1. Occasional entry into symbolically-fenced piping plover and least tern nesting areas will be permitted for assessing predator presence, setting traps, and shooting predators. USDA WS will maintain close coordination with piping plover and least tern monitors to document nest locations and to avoid/minimize disturbance.

2. In using non-lethal techniques to deter predators, USDA WS staff will not use pyrotechnics, visual deterrents, or other bird scare devices that may cause disturbance to piping plovers or least terns.

3. All foothold, cage, and body gripping traps will be placed outside of the immediate nesting areas. In most cases, these traps will be located in the dune vegetation where piping plovers and least terns are not known to visit. Location and baiting of traps will balance the efficacy of predator removal against risks of attracting predators to nesting areas.

4. Shooting activities will involve only occasional discharge of firearms in proximity of piping plovers and least terns. Multiple shotgun blasts will be avoided. When rifles are utilized, they will be used in conjunction with a noise suppressor. Night vision and spotlights will be used for night activities, but spotlights will not be directed at piping plovers and least terns.

New England Cottontails:

1. General provisions for all trapping activities will include:

    a) All traps used will meet the criteria of the Best Management Practices (BMP) for the specific target animal.

    b) All foothold trap pans will be adjusted to have approximately 2 lbs of pressure required for engagement of the jaws.

c) All foothold traps will be solidly anchored using either double rebar stakes, or cable earth anchors.

d) All foothold traps will be checked at or before sunrise to reduce human conflicts and minimize the length of time trapped animals spend in traps.

e) In general, most foothold traps will be set using scent attractors (lures and urines), and will be either dirthole, flat, or scent-post style trap sets.

f) If needed, USDA WS will establish additional contact with MDIFW regional staff and/or the Species Specialist for additional techniques for avoiding incidental take of New England Cottontails.

g) USDA WS will immediately report any take of a New England Cottontail to MDIFW regional staff and/or the Species Specialist (see Appendix B). This notification is required to determine the disposition of the rabbit (e.g. translocation, tagging, etc.)

h) USDA WS technicians will be trained on the handling of NEC for the purpose of assisting MDIFW with reintroduction/translocation efforts.

2. In areas where New England Cottontails are not known to inhabit (Table 1):

a) Foothold and body gripping traps will not be placed in areas with dense woody understory vegetation. Body gripping traps will be placed within 50 feet of the average high tide mark.

b) All trap types (foothold, conibear, cage, and weasel box) may be placed in areas containing sparse woody vegetation, but judgment will be used to avoid areas that would likely harbor New England Cottontails if they were present.

c) Blind (trail) sets may be used on occasion, but judgment will be used to locate them away from cover types that may be attractive to New England Cottontails. In general, these types of trap sets will be placed in areas located close to open, sandy habitat, which may be further described as the transition zone between the high tide zone and upland areas.

Table 1. Procedures to follow when trapping in areas NOT inhabited by New England Cottontails

Trap Type	**Can it be set in shrub cover?**	**Specific conditions**	**Distance from Woody Vegetation**	**% Groundcover**	**Comments**
Foothold	Yes, in open shrub/trees		0	NA	Blind sets in open areas only
Body-gripping	Yes		0	NA	For targeting mink; will be set near water (>50' of high tide)
Cage	Yes		0	NA	"Likely" areas will be avoided
Weasel Box	Yes	Entrance holes limited to 2.25"	0	NA	

2. In areas where New England Cottontails are <u>known</u> to inhabit (Table 1 and Appendix A):

a) No foothold or body gripping traps will be placed in areas containing woody vegetation and will be set a minimum of 50 feet from understory woody vegetation. Attempts will be made to limit foothold traps to areas of open sand and only sparse dune grass.

b) The location of cage traps may involve placement in areas of woody vegetation; however, cage traps will not be placed in areas containing dense vegetation of any kind. Only limited debris or vegetation will be used to conceal the trap. Cage traps will be baited with materials not believed to be attractive to New England Cottontails (in general, these will be fish-based lures or bait). Cage traps will be checked up to two times per day, and must be checked between the hours of 8:00 and 9:00 a.m. (if a cage trap is visited at sunrise, it must be re-checked the same day within the time period indicated above). Further, cage traps should not be placed in thick, rose-dominated shrubs that are located at the fringe of the dune (these are very likely areas for NEC to occupy).

c) Weasel box traps equipped with rat-size snap traps will contain entrance holes no greater than 2.25 inches in diameter, and will eliminate the chance that a rabbit would be caught; therefore, the placement of these devices will not be restricted.

d) Duffer-type foothold traps (also called egg traps, coon cuffs, bandit busters, Lil' Grizz Get'rz, etc.) that are designed primarily to catch raccoons may be set in any location.

Table 2. Procedures to follow when trapping in areas inhabited by New England Cottontails

Trap Type	**Can it be set in shrub cover?**	**Specific conditions**	**Distance from Woody Vegetation**	**% Groundcover**	**Comments**
Foothold	No		>50 feet	<50%	Open sand areas recommended
Body gripping	No		>50 feet	<50%	
Cage	Yes	2nd Check between 8-9 am	0	NA	Limit vegetation covering trap
Weasel Box	Yes	Entrance holes limited to 2.25"	0	NA	
Duffer-type	Yes	None	0	NA	

APPENDIX J

United States Department of Agriculture
Animal and Plant Health Inspection Service
WS Directive 2.201 07/21/08

WS DECISION MODEL

1. PURPOSE

To provide Wildlife Services (WS) personnel with a systematic approach to decision-making for wildlife damage management activities.

2. REPLACEMENT HIGHLIGHTS

This directive revises WS Directive 2.201 dated 10/29/03.

3. BACKGROUND

Wildlife damage management focuses on reducing conflicts between humans and wildlife that occur when wildlife negatively impact agricultural and natural resources, properties, and public health and safety. The WS decision making process is a thought process for evaluating and responding to wildlife damage problems, and is similar in approach to the decision making process used within other professions. WS professionals evaluate the appropriateness of strategies, and methods are evaluated for their availability (*i.e.*, legal and administrative) and suitability based on biological, economic, environmental and social considerations. Following the thought process, the methods deemed practical for the situation are developed into a management strategy. The WS Decision Model is designed to serve as a useful management tool and meaningful communication instrument; however, it necessarily oversimplifies complex thought processes.

4. POLICY

This directive provides WS personnel with a step-by-step approach to help address requests for assistance with wildlife damage. The major aspects presented in the WS Decision Model should be used when responding to requests for assistance. The WS Decision Model is intended to conceptualize and describe the thought process involved in addressing wildlife damage problems. It is not intended to require documentation or a written record each time it is used.

5. PROCEDURE

The following discussion is depicted in Attachment 1.

a. Receive Request For Assistance. Wildlife damage management services are provided only in response to requests for assistance.

b. Assess Problem. First, a determination should be made as to whether the problem is within the authority of WS. If it is, damage information should be gathered and analyzed to determine factors such as what species was responsible for the damage; the type, extent, and magnitude of damage; the current economic loss and potential losses; the local history of damage; and what management methods, if any, were used to reduce past damage and the results of those actions.

c. Evaluate Management Methods. Once a problem assessment is completed, an evaluation of management methods must be conducted. Methods should be evaluated in the context of their legal and administrative availability and their acceptability based on biological, environmental, social, and cultural factors.

d. Formulate Management Strategy. Methods determined to be practical for use are formulated into a management strategy. The concept of IWDM (WS Directive 2.105, The WS Integrated Wildlife Damage Management Program) should be applied when formulating each management strategy. This approach encourages the use of several management techniques rather than relying on a single method. Consideration of factors such as available expertise, legal constraints on methods used, costs, and effectiveness is essential in formulating each management strategy.

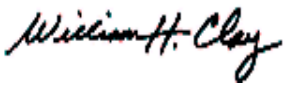
e. Provide Assistance. Program service can be provided by two basic means: technical assistance and direct management (WS Directive 2.101, Selecting Wildlife Damage Management Methods).

f. Monitor and Evaluate Results of Management Actions. When direct management is provided, it is necessary to monitor the results. Monitoring is important for determining whether further assistance is required or whether the problem has been resolved. Evaluation is used to determine whether additional techniques are necessary.

g. End of Project. With technical assistance, the projects normally end after recommendations or advice are provided to the requestor. An operational project normally ends when WS personnel have stopped or reduced the damage to an acceptable level. Problems such as chronic predation on livestock or at aquaculture facilities may require continuing or intermittent attention and may have no well-defined end point.

6. REFERENCES

WS Directive 2.101, Selecting Wildlife Damage Management Methods (10/29/03); www.aphis.usda.gov/wildlife_damage/directives/2.101.pdf
WS Directive 2.105, The WS Integrated Wildlife Damage Management Program (03/01/04); www.aphis.usda.gov/wildlife_damage/directives/2.105.pdf
ADC Final Environmental Impact Statement, Chapter 2.D.2.b – APHIS ADC Decision Model, pp 23-35 (October 1997).



Deputy Administrator

Attachment 1
WS Directive 2.2
07/21/08