ENVIRONMENTAL ASSESSMENT

MANAGEMENT OF PREDATION LOSSES TO THREATENED AND ENDANGERED SPECIES POPULATIONS IN THE COMMONWEALTH OF MASSACHUSETTS

Prepared by:

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

In Cooperation With:

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

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Table of Contents

LIST OF APPENDICES

ACRONYMS

APHIS	Animal and Plant Health Inspection Service
AVMA	American Veterinary Medical Association
BBS	Breeding Bird Survey
BMP	Best Management Practices
CBC	Christmas Bird Count
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CMR	Code of Massachusetts Regulations
DEA	Drug Enforcement Agency
EA	Environmental Assessment
ECOFRAM	Ecological Committee on FIFRA Risk Assessment
EIS	Environmental Impact Statement
EPA	Environmetnal Protection Agency
ESA	Endangered Species Act
FDA	Food and Drug Administration
FEIS	Final Environmental Impact Statement
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FONSI	Finding of No Significant Impact
FR	Federal Register
FY	Fiscal Year
MBTA	Migratory Bird Treaty Act
MDAR	Massachusetts Department of Agricultural Resources
MDFG	Massachusetts Department of Fish and Game
MDFW	Massachusetts Division of Fisheries and Wildlife
MESA	Massachusetts Endangered Species Act
MGL	Massachusetts General Laws
MOU	Memorandum of Understanding
NAS	National Audubon Society
NEPA	National Environmental Policy Act
NHESP	Natural Heritage and Endangered Species Program
NPS	National Park Service
NHPA	National Historic Preservation Act
NWR	National Wildlife Refuge
NWRC	National Wildlife Research Center
PAC	Problem Animal Control
PM	Predator Management
SOP	Standard Operating Procedure
T&E	Threatened and Endangered
USGS	United States Geological Survey
USC	United States Code
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
WS	Wildlife Services

CHAPTER 1: PURPOSE AND NEED FOR ACTION

1.1 PURPOSE

The United States Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), Wildlife Services (WS) program in the Commonwealth of Massachusetts continues to receive requests for assistance to resolve or prevent predation on nesting native bird populations on offshore islands and coastal areas associated with Virginia opossum (*Didelphis virginiana*), Norway rats (*Rattus norvegicus*), coyotes (*Canis latrans*), red fox (*Vulpes vulpes*), gray fox (*Urocyon cinereoargenteus*), raccoons (*Procyon lotor*), fisher (*Martes pennanti*), short-tailed weasel (*Mustela erminea*), long-tailed weasel (*Mustela frenata*), mink (*Mustela vison*), striped skunks (*Mephitis mephitis*), bobcats (*Lynx rufus*), feral cats (*Felis domesticus*) along with American crows (*Corvus brachyrhynchos*) and fish crows (*Corvus ossifragus*). Collectively, those species of wildlife are known to feed on eggs and nestlings of ground nesting shorebirds and colonial seabird species, including threatened and endangered bird species, and will be referred to as nest predators throughout this Environmental Assessment (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 NEPA (7 CFR 372.5(c), 60 FR 6000-6003).

The purpose of this EA is to evaluate activities conducted by WS to manage predation, and the threat of predation, caused by nest predators where a request for assistance is received. This EA will assist in determining if the proposed management of predation on nesting bird populations on offshore islands and coastal areas of the Commonwealth 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 nest predator damage management and will analyze alternative approaches to address those issues. In addition, this EA will be a planning document to coordinate efforts with other federal, Commonwealth, 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 nest predator damage management when requested, as coordinated between WS, the United States Fish and Wildlife Service (USFWS), and the Massachusetts Division of Fisheries and Wildlife (MDFW).

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

The EA evaluates the need for action to manage damage 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 address the need for action and the identified issues. Issues relating to the reduction of wildlife damage were raised during the scoping process for WS' programmatic FEIS (USDA 1997) and were considered in the preparation of this EA. The issues and alternatives associated with nest predator damage management were initially developed by WS in cooperation with the USFWS, and in consultation with the MDFW. The MDFW has regulatory authority to manage populations of wildlife in the Commonwealth while the management of native migratory bird populations is the overall responsibility of the USFWS. To assist with the identification of additional issues and alternatives to managing damage associated with nest predators in Massachusetts

this EA will be made available to the public for review and comment prior to a Decision[1].

1.2 NEED FOR ACTION

The coastal areas of Massachusetts including the ocean front (beaches) and outlying islands have been historically known for hosting large numbers of nesting, migrating, and wintering colonial waterbirds, waterfowl, shorebirds, raptors, and songbirds. Many of those areas are vacation areas that have experienced human population growth and urban sprawl over the years. Recognition of those areas as having a unique role in providing critical habitat to many wildlife species has motivated several federal, state, and municipal agencies along with non-profit organizations to acquire portions of the coastal and offshore island landscape for enhanced protection. Many threats, including habitat loss and degradation, severe weather events, predation, disease, sea level rise, water quality decline, and human disturbance, place the avian communities in jeopardy (The Nature Conservancy and National Oceanic and Atmospheric Administration 1996, Erwin et al. 2001, Erwin et al. 2003).

Many avian species nesting on the beaches and offshore islands in Massachusetts have stable or declining populations (see Table 1-1 and Table1-2). Those species that remain stable are all below what researchers believe to be sustainable populations. The species in decline appear to be impacted by predation on nesting birds or disturbance of nesting colonies by mammalian and avian predators (Hecht et al. 1996, Erwin et al. 2001). Declining species include least terns (*Sterna antillarum*), roseate terns (*Sterna dougallii*), arctic terns (*Sterna paradisaea*), and black skimmers (*Rynchops niger*). The piping plover (*Charadrius melodus*), a federal listed threatened species, is also found nesting on many of the coastal areas and offshore islands.

Nesting colonial waterbirds and shorebirds are valuable public and natural resources in Massachusetts. The proposed action would increase the abundance of some native colonial nesting waterbird and shorebird populations that ground nest on coastal areas and islands and whose populations have declined, in part, due to predation by native and introduced mammals and birds. The bird species this action intends to benefit are piping plovers, a federally listed threatened species; roseate terns, a federally listed endangered species; and various colonial and beach nesting waterbirds that are considered species of special concern by state and federal listing. These colonial nesting waterbirds and shorebirds include common terns (*Sterna hirundo*), least terns, arctic terns, American oystercatchers (*Haematopus palliatus*), and black skimmers.

Table 1-1: Inventory of Piping Plovers Nesting in Massachusetts, 2006-2010†.

Year	# of Pairs		# of Chicks Fledged[3]	# Pairs with Fledge Data
	Index Count[1]	Total Count[2]		
2006	518	486.5	684	492
2007	550	565	685	553
2008	551	582	785	572
2009	574	611.5	536	607.5
2010*	551	589	751**	N/A***

†Information for the table provided by the MDFW (S. Melvin, MDFW pers. comm. 2010).

[1]Index Count = number of pairs counted between June 1-9, 2009, the standardized Index Count period for the Atlantic Coast population.

[2] Total Count = total number of territorial or breeding pairs present at a site for at least 2 weeks during the breeding season.

[3]Chicks fledged are defined as chicks > 25 days of age or observed in flight, whichever occurs first. Number of pairs with fledge data includes

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

all pairs for which number of chicks fledged was determined; this includes not only pairs that successfully fledged chicks, but also pairs for which no nests were found, pairs that nested unsuccessfully, and pairs whose chicks failed to fledge.

* Preliminary data as of August 3, 2010.

** As of August 3, 2010, there are still 152 unfledged chicks.

*** N/A=Information is currently unavailable

Table 1-2: Inventory of Terns, Black Skimmers, and Laughing Gulls Nesting in Massachusetts, 2005-2009[†].

Year	Nesting Pairs by Species[1]					
	ROST	COTE	ARTE	LETE	BLSK	LAGU
2005	1,503	15,447	6	2,657	5	1,312
2006	1,648	16,001	2	2,615	4	1,492
2007	1,727	15,055.5	3.5	3,110	4	1,512
2008	1,410	15,842.5	4.5	3,776	5	1,582
2009	1,339	15,978.5	6.5	3,569	4	1,629

[†] Adapted from Mestello 2010

[1] ROST=Roseat Tern; COTE=Common Tern; ARTE=Artic Tern; LETE=Least Tern; BLSK=Black Skimmer; LAGU=Laughing Gull

The native ground nesting colonial waterbirds and shorebirds are preyed upon by native and introduced mammalian predators and abundant avian predators. The rates of predation on ground nesting bird eggs increase when predator density and diversity increase (Lariviere 2004). Mammalian predators include opossum, Norway rats, coyotes, red fox, gray fox, raccoons, fisher, short-tailed weasel, long-tailed weasel, mink, striped skunks, bobcats, and feral cats; all of which have healthy and sustainable populations in Massachusetts. The avian predators include fish crows and American crows. Both crow species have increased in abundance greatly in the 20th century (Sauer et al. 2011). American crows have a wide range and are extremely abundant, being found widely distributed over much of North America, including most of the United States (Johnson 1994, National Audubon Society 2000*a*). Fish crows primarily inhabit the coastal areas of the eastern and southeastern United States (Johnson 1994).

Need for Predator Management to Protect Natural Resources

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). Opossum, Norway rats, coyotes, red fox, gray fox, raccoons, fisher, short-tailed weasels, long-tailed weasels, mink, striped skunks, bobcats, feral cats, and crows prey on variety of natural resources. Normally, this predation would be considered part of the function of a healthy ecosystem. However, major changes have occurred in the ecosystem that encompasses the coastal region of the Commonwealth of Massachusetts. Recently, the role of predatory mammals and their effects on avian diversity in fragmented habitats have been revealed (Erwin et al. 2001). Additionally, these changes have had a profound negative impact on the viability of some native bird populations which ground nest on barrier islands and in coastal areas. Modern wildlife management action is needed to restore native ground nesting bird populations on offshore islands and in coastal areas in Massachusetts.

Native birds that 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). Mammalian predators on islands often cause complete failure of bird colonies to fledge any young (Craik 1997, Viksne 1997) or significant declines in chicks fledged (Clode and MacDonald 2002). Many of these colonial waterbird and shorebird species may be lost from the coastal and offshore island ecosystems unless action is taken to restore natural ecosystems within which

these birds evolved over time.

While conducting a site visit during the 2005 nesting season, red fox were determined to be the predators decimating a previously burgeoning colony in Plymouth, Massachusetts. In 2006, WS was requested to reduce predatioin risks to threatened and endangered shorebird and colonial nesting waterbirds in the Commonwealth. The removal of red fox that year resulted in an e increase in the number of birds using the site (*e.g*., common terns for example increased from 13 pairs in 2005 to 641 in 2006).

In 2010, a large colony of multiple species of terns, laughing gulls (*Larus atricilla*), and 19 pairs of piping plovers occurred at the site. The result appeared to be a very attractive feeding location for coyotes coming from the mainland. One coyote was removed in June 2010 and a necropsy was performed by WS. The necropsy revealed 3.4 pounds of tern chicks as the stomach contents of the coyote. With an estimated weight of ½ to 1 ounce per chick, this equated to between 50 and 100 chicks predated on that single night by that single coyote, demonstrating how truly destructive these predators can be to a colonial nesting site.

Impacts to native birds nesting on coastal areas and islands

As described in the following subsections, many native birds nesting on coastal areas in Massachusetts have declined in abundance since the 1970s. Concurrent with these declines has been expansion of coyote, red fox, gray fox, raccoon, skunk, opossum, and crow ranges and explosion of each predator's population numbers in coastal areas. In addition, some native ground nesting birds have abandoned islands because of mammalian and avian predation or inter-specific nest site competition with gulls.

Harm to shorebird populations

Shorebirds are species of birds that associate themselves with feeding, breeding, and roosting near water and they tend to be solitary nesters. They are characterized by small bodies, thin legs, and no or little webbing on their feet. Their bills come in a variety of shapes and sizes. The United States Shorebird Conservation Plan (Brown et al. 2001) provides a coordinated national initiative for shorebird conservation for 53 species that regularly occur in the United States. Shorebirds are represented by sandpipers, plovers, knots, avocets, oystercatchers, yellowlegs, godwits, dunlins, turnstones, dowitchers, whimbrels, curlews, snipe, and phalaropes.

Habitats used by shorebirds have been significantly altered in the United States, especially wetlands, shorelines, and grasslands. Many shorebird species face significant threats from habitat loss, human disturbance, and different forms of habitat degradation such as predation, pollution, and prey resources (Brown et al. 2001).

Piping plover

The piping plover is a federal listed threatened species protected by the Endangered Species Act. The coastal beaches and islands of Massachusetts comprise the most extensive and suitable habitat for nesting activities of most plover species in Massachusetts. Plover species have declined due to several factors, including mammalian and avian predation (Patterson et al. 1991, Kain 1996, Hecht et al. 1996, Boettcher 2002, Boettcher 2003).

The recovery objective for piping plovers is to remove them from the list of threatened and endangered species by: 1) achieving well-distributed increases in numbers and productivity of breeding pairs, and 2) providing for long-term protection of breeding and wintering plovers and their habitat (Hecht et al. 1996). The criteria for delisting the Atlantic population of piping plovers may be considered when the following

criteria have been met:

1. Increase and maintain for five years a total of 2,000 breeding pairs, distributed among four recovery units, with 625 pairs in the New England unit.

2. Verify the adequacy of a 2,000-pair population of piping plovers to maintain heterozygosity and allelic diversity over the long term.

3. Achieve five-year average production of 1.5 fledged chicks per pair in each of the four recovery units.

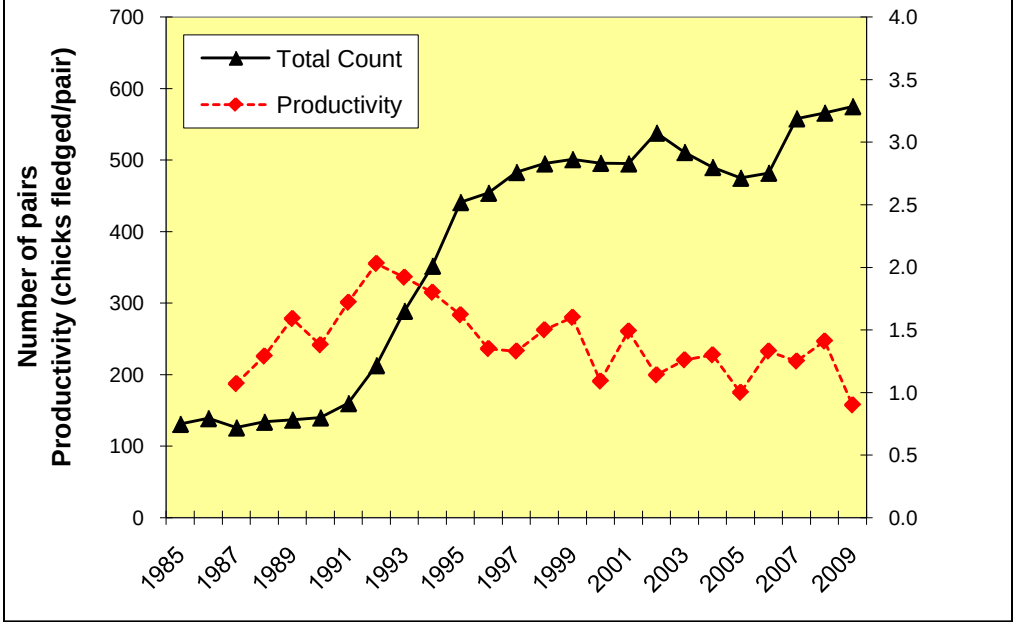
4. Institute long term agreements to assure protection and management sufficient to maintain the population targets and average productivity in each recovery unit.

5. Ensure long-term maintenance of wintering habitat to maintain survival for a 2,000 pair population.

The Commonwealth of Massachusetts is in the middle of the Atlantic coast piping plover's breeding range. Atlantic Coast plovers nest on coastal beaches, sand flats at the ends of sand spits and barrier islands, gently sloped fore dunes, sparsely vegetated dunes, and wash over areas cut into or between dunes (Hecht et al. 1996).

Gaines and Ryan (1988) estimated that 1.15 to 1.44 chicks must be fledged per pair to maintain a stable population. The Revised Piping Plover Recovery Plan calculated 1.25 chicks must be produced per pair for a stable population (Hecht et al. 1996). The number of piping plover chicks fledged per pair has been fluctuating in recent years however it has declined slightly since the early 1990s in Massachusetts (Fig. 1-1). Kruse et al. (2001) also found raccoons, American crows, and mink caused 98% of all piping plover nest loss in South Dakota. Red fox are also known nest predators of piping plovers (The Probe 1999).

Figure 1-1: Abundance and Productivity of Piping Plovers in Massachusetts, 1985-2009



Harm to colonial nesting water bird populations

Colonial nesting waterbirds are species of birds that associate themselves with feeding, breeding, and roosting near water and they nest in congregations or groups. These birds are represented by terns, gulls, skimmers, herons, egrets, cormorants, ibises, night herons, eiders, petrels, and guillemots. Colonial waterbirds are dependent on aquatic ecosystems for their survival. The North American Waterbird Conservation Plan (Kushlan et al. 2002) provides a continental framework for management of 210 species of waterbirds, including seabirds, coastal waterbirds, wading birds, and marsh birds utilizing aquatic habitats (Kushlan et al. 2002). The congregatory behavior of many waterbird species increases population risks by concentrating populations in limited areas (Kushlan et al. 2002). Eighty percent of waterbirds considered in the plan are colonial nesters (*i.e.*, colonial waterbirds). One third of colonial waterbirds are at risk for serious population loss (Kushlan et al. 2002). The threats the plan identifies as requiring remedial action include destruction of inland and coastal wetlands, introduced predators, invasive species, pollutants, mortality from fisheries and other human disturbances, disturbance, and conflicts arising from abundant species (Kushlan et al. 2002). Colonial waterbirds in Massachusetts are affected by introduced predators (*e.g.*, coyotes and opossum via range expansion); invasive species (*e.g.*, Norway rats and feral cats); human disturbance (on beaches during spring and summer), and conflicts arising from abundant species (*e.g.*, gray fox, raccoons, fisher, weasels, mink, skunks, bobcat, and fish and American crows).

Colonial waterbirds live in habitats used by other wildlife species and humans. Thus, the wisest choice of conservation action is within the context of multi-species and multi-use management (Kushlan et al. 2002). In protecting and managing aquatic habitats, the needs of all birds relying on these habitats should be coordinated (Kushlan et al. 2002). One of the objectives of this environmental assessment is developing and implementing management goals and actions for multiple bird and mammalian species living on coastal environments and barrier islands in Massachusetts. The bird species of interest include threatened and endangered birds, colonial waterbirds, and crows. The mammals of management interest are primarily coyotes, red fox, gray fox, raccoons, striped skunks, and opossums.

Roseate tern

The roseate tern is a federally listed endangered species protected by the Endangered Species Act as well as listed as an endangered species by the MDFW. The coastal beaches and islands of Massachusetts comprise the most extensive and suitable habitat for nesting activities of most tern species in Massachusetts. Roseate terns nested at only 4 sites in Massachusetts in 2009. The 1,339 pairs was the lowest total in Massachusetts since careful record keeping began in 1985 (Mostello 2010). Over the last 5 years, the number of roseate tern pairs has declined slightly in Massachusetts (see Fig. 1-2).

Least tern

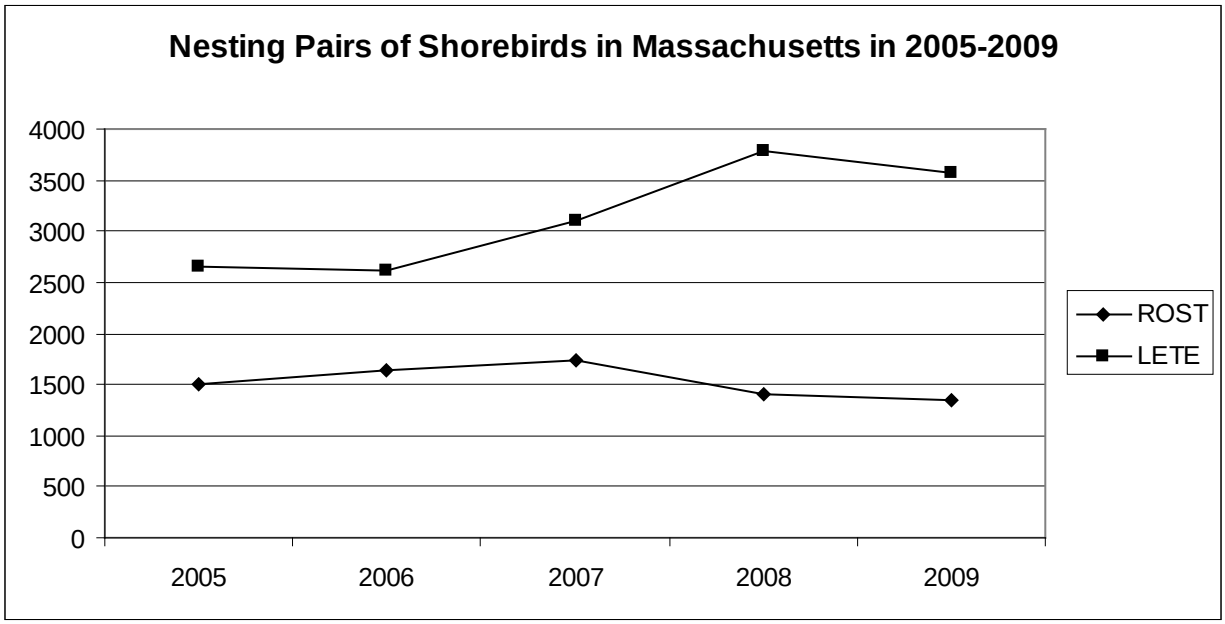
The least tern in Massachusetts is listed as a species of special concern. Of the species discussed, the least tern is the most widely distributed as it nested at 56 sites in Massachusetts during 2009 (Mostello 2010). Many of those sites were only a few pairs but there were eight sites that hosted over 100 pairs. Since 1985, the breeding population of least terns in Massachusetts shown a gradual overall increase, while 2005-2009 showed the population has had a relatively sharp increase after 2006 (see Fig. 1-2), possibly due to predator control work being conducted at several locations in Massachusetts. However, the number of breeding pairs observed in Massachusetts between 2001 and 2003, showed a large decline which provides an indication that such a large and rapid decline is of concern, even during long-term periods of increasing breeding populations.

Least terns were virtually eliminated along the east coast during the last quarter of the 19th century for the

millinery trade (Beck et al. 1990). In one three day period, 2,800 least terns were killed on Cobb Island, Virginia. By the 1920s and 1930s much of the east coast had been re-colonized. Least terns continued to increase until the 1950s and then started to decline.

Least terns nesting on coastal beaches and barrier islands are subject to a wide range of adverse conditions that can destroy large numbers of young and eggs, and force relocations of colonies from year to year (Beck et al. 1990). Under favorable climatic conditions, dramatic increases in populations can occur in a single breeding season (Beck et al. 1990). Flooding is the single greatest threat with its potential to obliterate entire colonies in a few hours (Beck et al. 1990). Although terns will re-nest two or three times in a single season, repeated washouts have occurred at critical times with devastating effect on the colonies (Beck et al. 1990).

Figure 1-2: Nesting Pairs of Roseate and Least Terns in Massachusetts 2005-2009



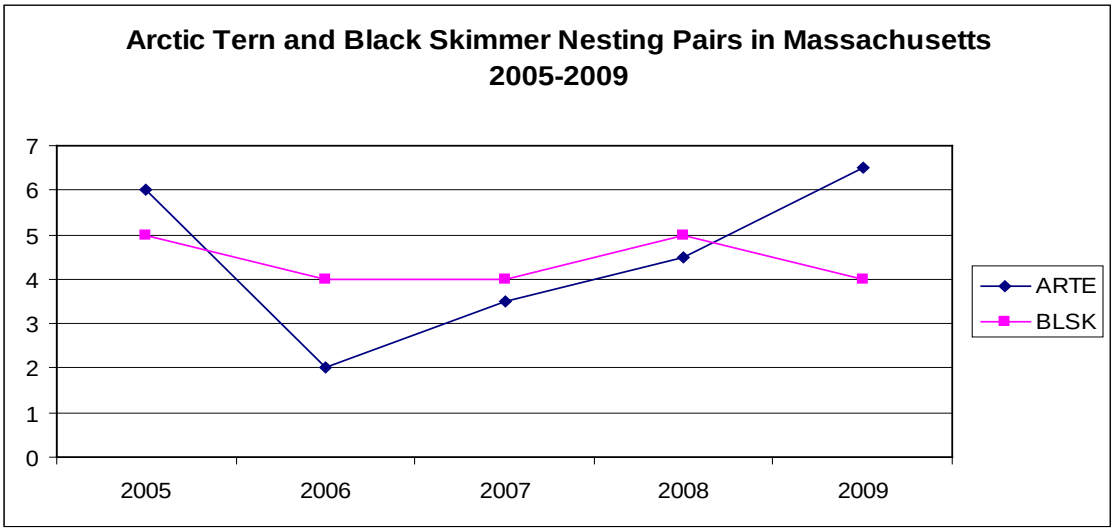
Arctic Tern

Arctic terns in Massachusetts are another species of special concern. Only a few pairs typically nest in Massachusetts (4.5 in 2008 and 6.5 in 2010) as this is the far southern reach of their breeding grounds (see Figure 1-3).

Black skimmer

Black skimmers are, like Arctic terns, at the far reaches of their breeding grounds except that skimmers are at the northern most reaches of their range. The result is only a few pairs of birds annually nesting in Massachusetts (see Figure 1-3).

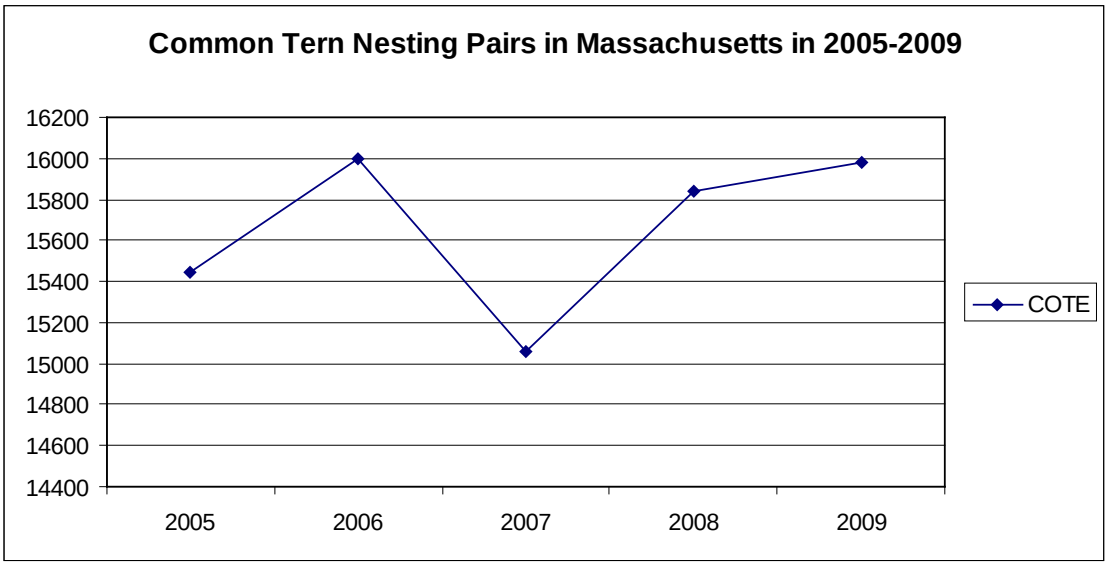
Figure 1-3: Arctic Tern and Black Skimmer Nesting Pairs in Massachusetts 2005-2009.



Common Tern

Of all of the species discussed in this section, common terns are by far the most abundant in Massachusetts. Since 1985, common tern numbers have risen in Massachusetts from less than 6,500 pairs to more than 16,000 in 2003 (Mostello 2010). Since 2003, the overall number of nesting pairs in Massachusetts has been relatively stable (see Figure 1-4) as the pairs have moved from nesting site to nesting site due to heavy predation at certain locations. However, it should be noted that breeding populations of common terns in Massachusetts remain at risk due to the limited and concentrated distribution of nesting terns. For instance, 98% of the nesting population of common terns in 2009 was concentrated in the 10 largest colonies with 67% occurring in just three colonies (Mostello 2010). Therefore, predation events could potentially cause the collapse of large colonies of common terns in a short period of time.

Figure 1-4: Common Tern Nesting Pairs in Massachusetts 2005-2009.



Effectiveness of predator removal to increase breeding bird 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). 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 share of nest failure 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 also significantly 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 (*i.e*., hunted versus non-hunted species)(Cote and Sutherland 1997).

Predator removal studies may fail to enhance breeding bird populations for hunted species because the fall population was reduced enough by hunting each year that fewer birds were available to breed in the spring (Cote and Sutherland 1997). In this instance the size of the breeding population remains stable due to hunting mortality. While the breeding bird population was not increased for some hunted species by predator removal, the number of chicks fledged was increased and, therefore, more game animals were made available for harvest during hunting seasons (Cote and Sutherland 1997).

The conservation practices of game and non-game birds should be integrated (Ball et al. 1994). Population declines of both game and non-game birds are a function of large-scale modification of the landscape and predator communities (Ball et al. 1994) due to human activity. Therefore, solutions that are most effective, efficient, and impact the greatest number of species of similar guilds would be conducted at a large scale, preferably at the landscape level.

Effectiveness of predator removal to increase non-game bird populations

Predation is one of many mortality factors that influence wildlife populations. Predators often play critical roles in the composition and function of wildlife populations in ecosystems (Witmer et al. 1996). The effects of predation on birds can be detrimental to local populations or islands, especially when predator densities are high or when predators gain access to areas not historically occupied (Bailey 1993, Stoudt 1982). In general, ground nesting birds suffer the highest predation rates, followed by cliff/burrow nesters. Tree nesters benefit from the lowest rates of predation (DeVos and Smith 1995).

Predator removal 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). Numerous studies have shown that nest predation accounts for the largest share of nest failures of Neotropical migratory songbirds and contribute to low recruitment rates (Heske et al. 2001, Nelson 2001). 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 and species composition of predator communities (Nelson 2001, Sovada et al. 2001). Also, when implemented, the effectiveness of predator removal to protect these non-game species has varied due to compensatory mortality (predator species composition), predator removal strategies and methodologies used (*i.e*., human bias), and geographic location. Some of these predator removal programs have resulted in increased populations and fledglings of species of management interest. Other

predator removal programs have had mixed effectiveness.

Butchko and Small (1992) conducted mammalian and avian predator removal in California to benefit the endangered California least tern. Coyotes, raccoons, skunks, ground squirrels, ravens, crows, kestrels, and loggerhead shrikes were preying on least tern nests and fledglings. Because other exclusion methods were unable to reduce predation to allow satisfactory productivity, predator removal was implemented. Prior to predator removal, there were 0.27 chicks fledged per breeding pair of least terns in 1987. After predator removal was initiated the number of chicks fledged ranged from 1.48 to 1.66 per pair in 1988. The number of chicks fledged increased in the early 1990s to the highest recorded number of chicks fledged (Butchko and Small 1992). A metapopulation model for the California least tern was developed to predict the persistence of the least tern population and the effects of various management actions (Akcakaya et al. 2003). The model demonstrated the reduction of predation did increase substantially the viability of the population under the assumption of low vital rates (*e.g.*, survival and fecundity).

Removal of medium sized predators (*e.g.*, raccoons, opossums, red fox, and skunks) has resulted in increased survival of waterfowl nests, hens, and ducklings fledged in prairie habitat (Garrettson et al. 1996). The impacts of medium sized predator removal on grassland nesting birds in prairie habitat has been less clear (Garrettson et al. 1996, Dion et al. 1999). The impacts appear confounded because of compensatory mortality where the removal of some predator species (*e.g.*, raccoons, skunks, and red fox) resulted in other species (*e.g.*, ground squirrels) increasing predation on grassland nesting songbirds (Dion et al. 1999).

Scale predator management needs to be conducted at to be effective

Predator removal can be conducted on comparatively small units of land or across the landscape. Garrettson et al. (1996) conducted raccoon, fox, and skunk removal on 10,240 acre blocks of prairie habitat to increase waterfowl productivity. Intense trapping did not remove all predators from these large blocks of prairie habitat (Garrettson et al. 1996). Hoff (1999) trapped duck nest predators in township size blocks (24,537 acres) to increase waterfowl nest success. Nest success was greater on trapped (36%) than untrapped (15%) areas (Hoff 1999). In contrast, Sargeant et al. (1995) removed the same waterfowl nest predators on 351 acre blocks of prairie habitat to increase waterfowl productivity. Chodachek (2003) removed nest and nesting duck predators from small sites (640 acres) annually and found nest success was about double from sites without predator management (53% versus 28.7%). Both approaches, trapping large blocks and small blocks of land resulted in increases in breeding waterfowl populations and number of fledgling produced. Although, trapping large blocks (24,537 acres) is more cost effective than trapping mid-size blocks (10,240 acres) or planting nesting cover (Hoff 1999).

1.3 SCOPE OF THIS ENVIRONMENTAL ASSESSMENT

Actions Analyzed

This EA evaluates the need for nest predator damage management to reduce threats of predation on eggs and nestlings of ground nesting bird species along the beaches and offshore islands within the Commonwealth of Massachusetts wherever such management is requested by a cooperator. Those nest predators identified in this assessment include Virginia opossum, Norway rats, coyotes, red fox, gray fox, raccoons, fisher, short-tailed weasels, long-tailed weasels, mink, striped skunks, bobcats, feral cats, American crows, and fish crows. This EA discusses the issues associated with conducting nest predator damage management in the Commonwealth 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[2]. The alternatives and Appendix B also discuss how methods would be employed to manage damage and threats associated with nest predators in the Commonwealth. Therefore, the actions evaluated in this EA are the use of those methods available under the alternatives and the employment of those methods by WS to manage or prevent damage and threats associated with nest predators from occurring when permitted by the USFWS and/or the MDFW.

The Migratory Bird Treaty Act (MBTA) makes it unlawful to pursue, hunt, take, capture, kill, possess, import, export, transport, sell, purchase, barter, or offer for sale, purchase, or barter, any migratory bird, or their parts, nests, or eggs (16 U.S.C 703-711). A list of bird species protected under the MBTA can be found in 50 CFR 10.13. American crows and fish crows are considered migratory bird species that are afforded protection from take under the MBTA.

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

Native American Lands and Tribes

Currently, WS does not have a Memorandum of Understanding (MOU) or signed cooperative service agreement with any Native American tribes in Massachusetts. If WS is requested by a tribe to conduct nest predator damage management activities, this EA would be reviewed and supplemented, if appropriate, to insure compliance with the NEPA.

Period for which this EA is Valid

If the analyses in this EA indicates an Environmental Impact Statement (EIS) is not warranted, this EA would remain valid until WS determines that new needs for action, changed conditions, new issues, or new alternatives having different environmental impacts must be analyzed. At that time, this analysis and document would be reviewed and supplemented pursuant to the NEPA. Review of the EA would be conducted each year to ensure that activities conducted under the selected alternative occur within the parameters evaluated in the EA. If the alternative analyzing no involvement in nest predator damage management activities by WS is selected, no annual analyses would occur based on the lack of involvement by WS. Annual monitoring of activities would ensure the EA remains appropriate to the scope of damage management activities conducted by WS in Massachusetts under the selected alternative if an EIS is not warranted.

Site Specificity

As mentioned previously, WS would only conduct activities when requested by the appropriate resource owner or manager. In addition, WS' activities that could involve the take of mammals or crows under the alternatives would only occur when permitted by the MDFW and the USFWS, when required, and only at levels permitted.

This EA analyzes the potential impacts of nest predator damage management and addresses activities on

[2]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 will be used by WS to resolve requests for assistance nor does the listing of methods imply that all methods will be used to resolve every request for assistance.

all private and public lands in Massachusetts where activities have occurred previously under a MOU, cooperative service agreement, and in cooperation with the appropriate public land management agencies. The EA also addresses the potential impacts of nest predator damage management on areas where additional MOUs, cooperative service agreements, or other comparable documents may be signed in the future. Because the need for action is to reduce nest predation and because the program's goals and directives are to provide services when requested, within the constraints of available funding and workforce, it is conceivable that additional mammal damage management efforts could occur. Thus, this EA anticipates that potential expansion and analyzes the impacts of such efforts as part of the alternatives.

The area encompassed by this EA where nest predator management could be conducted is within one mile of the mean high tide line of the 1,519 miles (2,444 km) of Massachusetts tidal shoreline, encompassing numerous inlets and islands. This area includes Essex, Suffolk, Norfolk, Plymouth, Barnstable, Bristol, Dukes, and Nantucket Counties. Because many species of colonial nesting birds can relocate their colony sites on a seasonal basis, almost any suitable habitat along the Massachusetts coast could potentially require nest predator management and would be covered under the scope of this EA.

Those species of wildlife that are known nest predators in the Commonwealth can be found statewide throughout the year in Massachusetts and are common in areas where colonial waterbirds nest. Planning for the management of nest predators must be viewed as being conceptually similar to federal or other agency actions whose missions are to stop or prevent adverse consequences from anticipated future events for which the actual sites and locations where they would occur are unknown but could be anywhere in a defined geographic area. Examples of such agencies and programs include fire and police departments, emergency clean-up organizations, and insurance companies. Although some of the sites where nest predator damage could occur can be predicted, all specific locations or times where such damage would occur in any given year cannot be predicted. The threshold triggering an entity to request assistance from WS to manage predation associated with nest predators is often unique to the individual; therefore, predicting where and when such a request for assistance would be received by WS is difficult. This EA emphasizes major issues as those issues relate to specific areas whenever possible; however, many issues apply wherever mammal damage and the resulting management actions occurs and are treated as such.

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

Under two of the alternatives, WS could continue to provide predator damage management activities on federal, Commonwealth, municipal, and private land in Massachusetts 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 damage 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.

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

The analyses in this EA are intended to apply to any action that may occur in any locale and at any time within the tidal shoreline, encompassing numerous inlets and islands in Massachusetts. In this way, the EA meets the intent of NEPA with regard to site-specific analysis and that this approach is the only practical way for WS to comply with the NEPA and still be able to address nest predation in the Commonwealth.

Summary of Public Involvement

Issues related to the potential management of nest predation were initially developed by WS in consultation with the USFWS and the MDFW. Issues were defined and preliminary alternatives were identified through the scoping process. As part of this process, and as required by the Council on Environmental Quality (CEQ) and APHIS' NEPA implementing regulations, this document will be noticed to the public through legal notices published in local print media, through 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 Massachusetts, and by posting the EA on the APHIS website at http://www.aphis.usda.gov/wildlife_damage/nepa.shtml.

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

1.4 RELATIONSHIP OF THIS DOCUMENT TO OTHER ENVIRONMENTAL DOCUMENTS

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

***WS' Environmental Assessment - Statewide Wildlife Damage Management at Airports in Massachusetts*:** In 2002, the WS program in the Commonwealth developed an EA to address the need to reduce threats associated with wildlife at airports (USDA 2002). The EA evaluated the issues associated with managing wildlife threats, including threats associated with those species addressed in this EA, except for fish crows, at airports and developed alternatives to address those issues. Based on the analyses in the EA, a Finding of No Significant Impact (FONSI) was issued selecting the proposed action in the EA to address the identified need. The proposed action evaluated an integrated approach using lethal and non-lethal methods to address the need for action. The analyses in the EA would remain appropriate for WS' activities conducted to reduce threats associated with wildlife, including those species addressed in the EA, at airports in the Commonwealth. The analyses in that EA will be discussed in this assessment to ensure WS' activities to address nest predation are evaluated cumulatively. A cumulative assessment of activities conducted by WS in the Commonwealth will assist in determining if those activities are sufficient to warrant the preparation of an EIS.

***WS' Environmental Assessment - Reducing Gull Damage in the Commonwealth of Massachusetts*:** In 2010, the WS program in the Commonwealth developed an EA to address the need to reduce damage and threats associated with laughing gulls, ring-billed gulls, herring gulls, and great black-backed gulls throughout the Commonwealth (USDA 2010). The EA evaluated the issues associated with managing gull damage and threats, including threats associated with gull predation of colonial nesting birds and

threatened and endangered (T&E) species and developed alternatives to address those issues. Based on the analyses in the EA, a FONSI was issued selecting the proposed action in the EA to address the identified need. The proposed action evaluated an integrated approach using lethal and non-lethal methods to address the need for action. The analyses in the EA would remain appropriate for WS' activities conducted to reduce threats associated with gulls, including those species addressed in the EA, to alleviate predation of colonial nesting birds and T&E species in the Commonwealth. The analyses in that EA will be discussed in this assessment to ensure WS' activities to address nest predation are evaluated cumulatively. A cumulative assessment of activities conducted by WS in the Commonwealth will assist in determining if those activities are sufficient to warrant the preparation of an EIS.

1.5 AUTHORITY OF FEDERAL AND COMMONWEALTH AGENCIES

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

WS' Legislative Authority

The primary statutory authority for the WS program is 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). 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 and their habitats for the continuing benefit of the American people. Responsibilities are shared with other federal, Commonwealth, tribal, and local entities; however, the USFWS has specific responsibilities for the protection of T&E species under the Endangered Species Act (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 Act. 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 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.

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.

Massachusetts Department of Fish and Game

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

Massachusetts Division of Fisheries and Wildlife

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

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

Massachusetts Department of Agricultural Resources, Division of Regulatory and Consumer Services, Pesticide Bureau

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

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, Commonwealth, and local laws and regulations in accordance with WS Directive 2.210.

National Environmental Policy Act

All federal actions are subject to the NEPA (Public Law 9-190, 42 U.S.C. 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 consulting 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 Commonwealth. When WS' direct management assistance is requested by another federal agency, compliance with the NEPA is the responsibility of the other federal agency.

Migratory Bird Treaty Act of 1918 (16 U.S.C. 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 be in compliance 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 lethal take blackbirds when those species are "*. . . found committing or about to commit depredations upon ornamental or shade trees, agricultural crops, livestock, or wildlife, or when concentrated in such numbers and manner as to constitute a health hazard or other nuisance*." Those bird species that can be lethally taken under the blackbird depredation order that are addressed in the assessment include American crows and fish crows.

Endangered Species Act

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

WS has conducted a formal consultation with the USFWS on programmatic activities and received a Biological Opinion (BO) describing potential effects on T&E species which prescribes reasonable and prudent measures for avoiding jeopardy (USDA 1997). As part of the development of this EA, WS has also consulted with the USFWS regarding T&E species in Massachusetts in regards to nest predator damage management activities proposed which will be discussed in Chapter 4 of this EA.

Additionally, WS is currently listed as a subpermittee under the Regional Endangered Species Permit issued by the USFWS which authorizes WS' personnel to conduct wildlife damage management activities to alleviate avian and mammalian predation to federally listed threatened piping plovers on coastal Massachusetts beaches (P. Phifer, USFWS pers. comm. 2010).

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 under the alternatives are registered with and regulated by the EPA and the MDFW and/or the Massachusetts Department of Agricultural Resources, and would be used by WS in compliance with labeling procedures and requirements. No toxicants are currently used or registered for use in managing mammalian nest predators in the Commonwealth. During the development of this assessment, the repellent Avitrol and the avicide DRC-1339 were registered for use in the Commonwealth to alleviate damage and the threat of damage associated with crows. Although not currently registered for use in the Commonwealth, the repellent mesurol has been registered with the EPA to discourage predation by crows on the eggs of T&E species.

Federal Food, Drug, and Cosmetic Act (21 U.S.C. 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 U.S.C. 821 et seq.)

This law requires an individual or agency to have a special registration number from the federal Drug

Enforcement Agency (DEA) 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 and its implementing regulations (21 CFR Part 530) establish several requirements for the use of animal drugs, including those used to capture and handle wildlife in damage management programs. Those requirements are: (1) a valid "*veterinarian-client-patient*" relationship, (2) well defined record keeping, (3) a withdrawal period for animals that have been administered drugs, and (4) identification of animals. A veterinarian, either on staff or on an advisory basis, would be involved in the oversight of the use of animal capture and handling drugs under the proposed action. Veterinary authorities in each state have the discretion under this law to establish withdrawal times (*i.e.*, a period of time after a drug is administered that must lapse before an animal may be used for food) for specific drugs.

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 are only conducted at the tribe's request and under signed agreement; thus, the tribes have control over any potential conflict with cultural resources on tribal properties.

Each method described in this EA that might be used operationally by WS 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 proposed action are not generally the types of activities that would have the potential to affect historic properties. If an individual activity with the potential to affect historic resources is planned under an alternative selected as a result of a decision on this EA, then site-specific consultation as required by Section 106 of the NHPA would be conducted as necessary.

There is potential for audible effects on the use and enjoyment of a historic property when methods such as pyrotechnics, firearms, and other noise producing methods are used at or in close proximity to such sites for purposes of resolving nest predation. However, such methods would only be used at a historic site at the request of the owner or manager of the site to resolve damage or the threat of damage, which means such use would be to benefit the historic property. A built-in mitigating factor for this issue is that virtually all of the methods involved would only have temporary effects on the audible nature of a site and can be ended at any time to restore the audible qualities of such sites to their original condition. Site-specific consultation as required by Section 106 of the NHPA would be conducted as necessary in those types of situations.

Coastal Zone Management Act of 1972, as amended (16 USC 1451-1464, Chapter 33; P.L. 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.

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 uses only legal, effective, and environmentally safe wildlife damage management methods, tools and approaches. All chemicals used by WS are regulated by the EPA through FIFRA, the Massachusetts Department of Agricultural Resources, Division of Regulatory and Consumer Services, Pesticide Bureau, the FDA, by MOUs with land managing agencies, and by WS' Directives. Based on a thorough Risk Assessment, APHIS concluded that when WS' program chemicals are used according to label directions, they are selective to target individuals or populations, and such use has negligible impacts on the environment (USDA 1997). WS would properly disposes of any excess solid or hazardous waste. It is not anticipated that the proposed action would result in any adverse or disproportionate environmental impacts to minority and low-income persons or populations. In contrast, the proposed action may benefit minority or low-income populations by reducing threats to public health and safety and property damage.

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

Children may suffer disproportionately for many reasons from environmental health and safety risks, including the development of their physical and mental status. WS 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. All known nesting areas of federally and state listed T&E colonial waterbirds and shorebirds in Massachusetts are closed to public access during the nesting season, as are most of those of spieces of special concern. Most, if not all entities engaged in managing nesting colonial waterbirds and shorebirds restrict public access to active and historic nesting areas during the nesting season. For those reasons, WS concludes that it would not create an environmental health or safety risk to children from implementing the proposed action alternative or the other alternatives.

Invasive Species - Executive Order 13112 of February 3, 1999

Executive Order 13112 prevents the introduction of invasive species and provides for their control to minimize the economic, ecological, and human health impacts that invasive species cause. Norway rats and feral cats are recognized as invasive species that have adverse economic, ecological, and human health impacts.

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.

Inland Fisheries and Game and Other Natural Resources (MGL c.131: Regulations 321 CMR 1.00 to 11.00)

This law establishes the MDFG and under it the Division of Fisheries and Wildlife. It also provides for the Fisheries and Wildlife Board and the Director of the Division of Fisheries and Wildlife and designates their responsibilities and powers. Regulations established pursuant to this statute regulate trapping, hunting, problem animal management, and wetlands protection.

Leghold Traps and Certain Other Devices Restricted; Punishment/Use of Certain Traps for the Taking of Fur-bearing Mammals (MGL c.131 Section 80A: Regulations 321 CMR 2.08)

This law bans the use, manufacture, or possession any trap for the purpose of capturing furbearing mammals, except for common type mouse and rat traps, nets, and box or cage type traps, as otherwise permitted by law. A box or cage type trap is defined by this law as one that confines the whole animal without grasping any part of the animal. Other than nets and common type mouse or rat traps, traps designed to capture and hold a furbearing mammal by gripping the mammal's body, or body part are prohibited, including steel jaw leghold traps, padded leghold traps, snares and species specific traps such as those used to capture raccoons. Conibear traps are allowed for controlling beaver and muskrat to protect human health and safety. However, the MDFW acknowledges that this restriction does not apply to WS activities on federal lands (W. MacCallum, MDFW pers. comm. 2010).

Massachusetts Endangered Species Act (MESA) (M.G.L c.131A and regulations 321 CMR 10.00)

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

Massachusetts Pesticide Control Act (MGL c.132B)

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

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. In addition, the USFWS is responsible for the management of wildlife on the NWR system and other federally controlled properties where activities could be conducted. As the authority for the management of bird populations and wildlife on federally controlled properties, the USFWS was involved in the development of the EA and provided input throughout the EA preparation process to ensure an interdisciplinary approach according to the NEPA and agency mandates, policies, and regulations. The MDFW is responsible for managing wildlife in the Commonwealth, including those species of wildlife identified as nest predators in the Commonwealth. The MDFW establishes and enforces regulated hunting and trapping seasons in the Commonwealth. Any activities to reduce and/or prevent nest predation in Massachusetts would be coordinated with the USFWS and the MDFW which ensure WS' actions are incorporated into population objectives established by those agencies for those wildlife populations in the Commonwealth. The USFWS and the MDFW reviewed the EA to identify issues, alternatives, and to ensure compliance with Commonwealth laws and regulations.

Based on the scope of this EA, the decisions to be made are: 1) should WS continue to conduct nest predator damage management to alleviate and prevent predation on ground nesting waterbirds, 2) should WS implement an integrated damage management strategy, including technical assistance and direct operational assistance, to meet the need for nest predator damage management in Massachusetts, 3) if not, should WS attempt to implement one of the alternatives to an integrated damage management strategy as described in the EA, and 4) would the proposed action result in adverse impacts to the environment requiring the preparation of an EIS.

CHAPTER 2: AFFECTED ENVIRONMENT AND ISSUES

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

2.1 AFFECTED ENVIRONMENT

Nest predator damage management would only be conducted by WS when requested by a landowner or manager and only on properties where a cooperative service agreement or other comparable document has been signed between WS and a cooperating entity. Most species of nest predators addressed in this EA can be found throughout the year across the Commonwealth where suitable habitat exists for foraging and shelter. Those species addressed in this EA are capable of utilizing a variety of habitats in the Commonwealth. As previously stated, the area encompassed by this EA where nest predator management could be conducted is within one mile of the mean high tide line of Massachusetts in eight of the 14 counties in appropriate nesting habitat of those species being protected with current or historical nesting activity.

In 2009, there were 138 coastal sites surveyed in Massachusetts for the presence of breeding roseate terns, common terns, Arctic terns, least terns, laughing gulls, and black skimmers. Seventy-eight sites were occupied by nesting birds of one or more of those species in Massachusetts during 2009 (Mostello 2010). There were 220 coastal sites surveyed at least once in Massachusetts for the presence of breeding piping plovers during the 2009 nesting season. Of those, 125 sites reported breeding pairs of plovers (Melvin 2010). Additional information on the affected environment is provided in Chapter 4.

2.2 ISSUES ADDRESSED IN THE ANALYSIS OF ALTERNATIVES

Issues are concerns of the public and/or professional community raised regarding potential adverse affects that might occur from a proposed action. Such issues must be considered in the decision-making process in accordance with the NEPA. Issues relating to the reduction of wildlife damage were raised during the scoping process for WS' programmatic FEIS (USDA 1997) and were considered in the preparation of this EA. Issues related to managing nest predation in Massachusetts were developed by WS in consultation with the USFWS and the MDFW. The EA will also be made available to the public for review and comment to identify additional issues.

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

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

A common issue when addressing damage caused by wildlife are the potential impacts of management actions on the population of target species. Wildlife species specifically addressed in this EA include the include Virginia opossum, Norway rat, coyotes, red fox, gray fox, raccoons, fisher, short-tailed weasel, long-tailed weasel, mink, striped skunks, bobcat, feral cats, American crows, and fish crows. Methods used to resolve nest predation can involve altering the behavior of target species and may require the use of lethal methods when appropriate. Methods currently being considered for use to alleviate or manage nest predation are described in Appendix B of this EA. The use or recommendation of methods by WS under the alternatives would occur as governed by federal, Commonwealth, and local laws and regulations.

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 would be employed to remove an individual target species or several individuals of target species. The use of lethal methods would therefore result in local population reductions in the area where nest predations was occurring or could occur. 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 given wildlife species involved with the associated damage or threat, and the efficacy of methods employed.

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

would cause significant adverse impacts to the viability of native species populations (USDA 1997). All lethal take (killing) of wildlife by WS would occur at the requests of a cooperator seeking assistance and only after the take of those wildlife species identified as targets has been permitted by the USFWS pursuant to the MBTA, when required, and by the MDFW, when required.

WS' proposed action incorporates an adaptive approach to resolve nest predation by targeting individual nest predators or groups of nest predators using non-lethal and lethal methods after applying the WS' Decision Model (Slate et al. 1992, USDA 1997) to identify possible techniques. Lethal methods could be used to reinforce non-lethal methods to reduce nest predation to a level that is more acceptable to the requester. The effects on the populations of those target species in Massachusetts from implementation of the identified alternatives, including the proposed action, are analyzed in Chapter 4.

Information on bird populations and trends are often derived from several sources including the Breeding Bird Survey (BBS), the Christmas Bird Count (CBC), 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 along roadways for a set duration along a pre-determined route. The number and species of birds observed and heard within a quarter of a mile of the survey points are recorded. 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 a combined set of over 3,700 roadside survey routes conducted annually in the continental United States and southern Canada, 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. 2008). The primary objective of the BBS has been to generate an estimate of population change for all breeding birds. Populations of birds tend to fluctuate, especially locally, as a result of variable local habitat and climatic conditions. Trends can be determined using different population equations and statistically tested to determine if a trend is statistically significant.

Estimates of population trends from BBS data are derived primarily from route-regression analysis (Geissler and Sauer 1990) and are dependent upon a variety of assumptions (Link and Sauer 1998). The statistical significance of a trend for a given species is reflected in the calculated P-value (*i.e.*, the probability of obtaining the observed data or more extreme data given that a hypothesis of no change is true). The level of statistical significance (*e.g.*, 0.01, 0.05, 0.10) can vary and is often set by those conducting the analysis. Often BBS or other geographically large survey data is not statistically significant at the local level because of relatively smaller sample size (*i.e.*, fewer routes surveyed), more routes with zero observations of a particular bird species which results in larger statistical variance and low P-values set for statistical significance. The data reported from the BBS has a statistical level of significance set at $P<0.05$ (Sauer et al. 2008).

Christmas Bird Count

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

data tend to correlate well with those from censuses taken by more stringent means (NAS 2010).

Partners in Flight Landbird Population Estimate

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

Annual Harvest Estimate

The populations of crows and most of the mammalian predators addressed in this EA are sufficient to allow for harvest seasons that typically occur during the fall of each year. Migratory bird hunting seasons are established under frameworks developed by the USFWS and implemented in the Commonwealth by the MDFW. For crows, take can also occur under the blackbird depredation order established by the USFWS. Therefore, the take of crows can occur during annual hunting seasons and under the depredation order that allows crows to be taken to alleviate damage and to alleviate threats of damage. Most of the mammalian species addressed in this assessment can be harvested in the Commonwealth during annual hunting and trapping seasons which allows an unlimited number of each species to be taken and possessed throughout the season. The exceptions are feral cats and Norway rats which are consided feral and/or invasive exotic species in Massachusetts which receive no protection under federal or Commonwealth laws or regulations. Within budgetary limits, WS is required to control populations of invasive exotic species in a cost-effective and environmentally sound manner under Executive Order 13112. In the past, a harvest quota existed for bobcats in Massachusetts; however, starting in 2011 this quota has been eliminated (MDFW 2011).

Issue 2 - Effects of Damage Management 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, exclude, capture, or kill non-target wildlife. As discussed under Issue 1, non-lethal methods being employed to disperse or otherwise make an area unattractive to target species can also reduce the presence of those non-target species at the site and potentially the immediate area around the site. Lethal methods being employed to take target species that are available under the alternatives could unintentionally lethally take non-target species. The unintentional lethal take of non-target species could potentially lead to a reduction in the number of individuals of those non-target species at the site where methods are employed.

Concerns have also been raised about the potential for adverse affects to occur to non-target wildlife from the use of registered pesticides. Chemical methods being considered for use to reduce or prevent nest predation includes the avicide DRC-1339, Avitrol, and mesurol which are further discussed in Appendix B. WS would also use SOPs designed to reduce the effects on non-target species' populations. SOPs are further discussed in Chapter 3. Methods available for use under the alternatives are described in Appendix B.

Issue 3 – Effects of Damage Management 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)].

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

Issue 4 - Effectiveness of Nest Predator Damage Management

Some concerns have been raised about the effectiveness of nest predator damage management in reducing predation and increasing fecundity of native ground nesting bird species populations in coastal areas and on offshore islands of Massachusetts to the desired population goals and objectives. The desired objective of nest predator management is to increase fledgling rates of protected species to levels that allow local populations to stabilize or increase. The ultimate goal of nest predator management is to assist in ensuring at risk species do not require state or federal listing and to assist in population recovery and ultimately delisting of state and federally listed species as part of coordinated recovery plans developed by resource managers and the USFWS.

The effectiveness of any damage management program could be defined in terms of losses or risks potentially reduced or prevented, how accurately practitioner's diagnosis the problem, the species responsible for the damage, and how actions are implemented to address risks or damages. To determine that effectiveness, WS must be able to complete management actions expeditiously to minimize harm to non-target animals and the environment, while at the same time, using methods as humanely as possible within the limitations of current technology, funding, and workforce. Efficacy is based on the types of methods employed, the application of the method, restrictions on the use of the method(s), the skill of the personnel using the method and, for WS' personnel, the guidance provided by WS' Directives and policies. The goal is to reduce damage, risks, and conflicts with nest predators as requested and not to reduce/eliminate wildlife populations over broad areas. Localized population reduction could be short-term and new individuals may immigrate or be born to animals remaining at the site (Courchamp et al. 2003). A common issue raised is that the use of lethal methods is ineffective because additional target wildlife is likely to return to the area which would create a financial incentive to continue the use of only lethal methods.

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 damage caused by target species. Both chemical and non-chemical methods have the potential to have adverse affects on human safety. WS' employees use and recommend only those methods which are legally available, selective for target species, and effective to resolve the wildlife conflict. Still, some concerns exist regarding the safety of WS' methods despite their legality. As a result, WS will analyze

the potential for proposed methods to pose a risk to members of the public or employees of WS.

In addition to the potential risks to the public associated with WS' methods, risks to employees are also an issue. WS' employees are potentially exposed to damage management methods as well as subject to workplace accidents.

Safety of Chemical Methods Employed

The issue of using chemical methods as part of managing damage associated with wildlife relates to the potential for human exposure either through direct contact with the chemical or exposure to the chemical from wildlife that have been exposed. Under the alternatives identified, the use of chemical methods would be limited to immobilizing drugs, euthanasia drugs, repellents, and avicides. A list and description of chemical methods available for use under the identified alternatives can be found in Appendix B and will be discussed further in Chapter 4. The use of chemical methods is regulated by the EPA through the FIFRA, by the FDA, by the DEA, and by Commonwealth laws and regulations. WS' use of chemical methods is further discussed in WS' programmatic FEIS (USDA 1997).

Safety of Non-Chemical Methods Employed

Non-chemical methods employed to reduce or prevent nest predation, if misused, could potentially be hazardous to human safety. A complete list of non-chemical methods available to alleviate damage associated with nest predators is provided in Appendix B of this EA. 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; thereby, making the cooperator aware of the use of those methods on property they own or manage to identify any risks to human safety associated with the use of those methods.

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 the wildlife species addressed 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 a large percentage 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 is variable and mixed to wildlife damage management because there are numerous philosophical, aesthetic, and personal attitudes, values, and opinions about the best ways to manage conflicts/problems between humans and wildlife.

Wildlife populations provide a wide range of social and economic benefits (Decker and Goff 1987). Those 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 (*i.e.*, using parts of or the entire animal) or non-consumptive use (*i.e.*, viewing the animal in nature or in a zoo, photographing) (Decker and Goff 1987).

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

Public attitudes toward wildlife vary considerably. Some people believe that all wildlife should be captured and translocated to another area to alleviate damage or threats to protected resources. Some people directly affected by the problems caused by wildlife strongly support removal. Individuals not directly affected by the harm or damage may be supportive, neutral, or totally opposed to any removal of wildlife from specific locations or sites. Some people totally opposed to wildlife damage management want 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 certain wildlife species, such as opossums, raccoons, fox, coyotes, or feral species, such as cats. To such people those species represent pests which are nuisances and which 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 a 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 suffering, as it relates to methods available for use to manage nest predation by those wildlife species addressed in this EA 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 foot-hold traps or changes in the blood chemistry of trapped animals, indicate "*stress*" (USDA 1997). However, such research has not

yet progressed to the development of objective, quantitative measurements of pain or stress for use in evaluating humaneness.

The 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 and invasive animals. However, the AVMA states that "[f]*or wild and feral animals, many of the recommended means of euthanasia for captive animals are not feasible. In field circumstances, wildlife biologists generally do not use the term euthanasia, but terms such as killing, collecting, or harvesting, recognizing that a distress- free death may not be possible*" (Beaver et al. 2001).

The decision-making process involves tradeoffs 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 within the constraints imposed by current technology.

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

Another issue commonly identified is a concern that wildlife damage management activities conducted by WS 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. The only wildlife species addressed in this EA that do not have annual hunting and/or trapping seasons within the Commonwealth are the Norway rat and feral cats. During the development of this EA, annual hunting and/or trapping seasons existed in the Commonwealth for Virginia opossum, coyotes, red fox, gray fox, raccoons, fisher, short-tailed weasel, long-tailed weasel, mink, striped skunks, bobcat, American crows, and fish crows (MDFW 2011).

Skunks and weasels have continuous open hunting seasons within the Commonwealth and can be hunted throughout the year (except during shotgun deer season) with no limit on the number that can be lethally taken or possessed. Bobcats, coyotes, red fox, gray fox, raccoons, opossum, American crows, and fish crows can also be harvested during annual hunting seasons in the Commonwealth. During the open seasons for those species, there is no limit on the number of those species that can be harvested daily and no limit on the number that can be possessed throughout the season. The only exception is the daily limit for raccoons during the hunting season which restricts the daily harvest to three raccoons with no limit on the number that can be harvested during the entirerty season. In addition, bobcats, coyotes, red fox, gray fox, weasels, fishers, mink, opossum, raccoons, and skunks could be harvested during annual trapping seasons within the Commonwealth. During the open trapping seasons, an unlimited number of those species could be harvested daily with no limit on the number that can be possessed throughout the season (MDFW 2011).

Potential impacts could arise from the use of non-lethal or lethal damage management methods that would be available to manage nest predation under the alternatives. Non-lethal methods used to reduce or alleviate damage caused by those wildlife species are used to lower local densities through dispersal in areas where nest predation is occurring or could occur. Similarly, lethal methods used to reduce or prevent nest predation associated with those wildlife species addressed in this EA could lower densities in areas where predation is occurring or could occur resulting in a reduction in the availability of those species during the regulated harvest seasons. Nest predator damage management activities would primarily be conducted in areas where hunting and trapping access is restricted (*e.g.*, National Wildlife

Refuges) or has been ineffective. The use of non-lethal often disperses wildlife from areas where damage is occurring to areas outside the damage area which could serve to move those species from those less accessible areas to places accessible to hunters.

Issue 9 - Effects on Recreation in Areas Where Damage Management Activities are Conducted

Coastal areas and offshore islands are used for swimming, fishing, sunbathing, picnics, shell collecting, hunting, bird watching, trapping furbearers, walking pets, and other outdoor activities. Some people would be concerned that management activities would restrict recreation in those areas by limiting access to those locations.

2.3 ISSUES CONSIDERED BUT NOT ANALYZED IN DETAIL WITH RATIONALE

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

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

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

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

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

WS' Impact on Biodiversity

The WS program does not attempt to eradicate any species of native wildlife in the Commonwealth. WS operates in accordance with applicable international, federal, and Commonwealth laws and regulations enacted to ensure species viability. The methods available under the alternatives are employed to target individual nest predators or groups of nest predators in those areas where ground nesting colonial waterbirds occur to prevent or reduce nest predation. Any reduction of a local wildlife population or group that could occur from the use of methods is frequently temporary because immigration from adjacent areas or reproduction replaces the animals removed. WS operates on a small percentage of the land area in Massachusetts and only targets those nest predators identified in areas where nest predation has occurred or could occur. Therefore, impacts on biodiversity associated with nest predator damage management would not adversely affect biodiversity in the Commonwealth.

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.

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

Nest Predator Damage Management Should Not Occur at Taxpayer Expense

An issue identified through the development of WS' programmatic FEIS is the concern that wildlife damage management should not be provided at the expense of the taxpayer or that activities should be fee-based (USDA 1997). Funding for nest predator damage management activities is derived from federal appropriations and through cooperative funding. Activities conducted in the Commonwealth for the management of nest predation would be funded through cooperative service agreements with individual property owners or associations. Therefore, funding for damage management activities is derived primarily from those entities requesting assistance from WS.

Cost Effectiveness of Management Methods

The CEQ does not require a formal, monetized cost benefit analysis to comply with the NEPA. Consideration of this issue is not essential to making a reasoned choice among the alternatives being considered. However, the methods determined to be most effective to reduce or prevent nest predation and that prove to be the most cost effective would receive the greatest application. As part of an integrated approach, the evaluation of methods would occur continuously which allows for those methods that are most effective at resolving or preventing nest predation to be employed under similar circumstance. Additionally, management operations may be constrained by cooperator funding and/or objectives and needs. The cost effectiveness of methods and the effectiveness of methods are linked.

Nest Predator Damage 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 problem animal control (PAC) agent, also referred to as a nuisance wildlife control agent, because the PAC agent is located in closer proximity and thus could provide the service at less expense, or because they prefer to use a private business rather than a government agency. However, some property owners would prefer to contract with a government agency. In particular, large non-governmental organizations and cities and towns may prefer to use WS because of security and safety issues.

Effects from the Use of Lead Ammunition in Firearms

Questions have arisen about the deposition of lead into the environment from ammunition used in firearms to lethally take wildlife. The direct use of firearms by WS to alleviate or prevent nest predation would only be available under the proposed action alternative; however, firearms could be employed by other entities to alleviate or prevent nest predation under any of the alternatives. As described in Appendix B, the lethal removal of wildlife with firearms by WS to alleviate damage or threats, when deemed appropriate, could occur using a rifle or shotgun. In an ecological risk assessment of lead shot exposure in non-waterfowl birds, ingestion of lead shot was identified as the concern rather than just contact with lead shot or lead leaching from shot in the environment (Kendall et al. 1996). To address lead exposure from the use of shotguns, the 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. Under the proposed action alternative, shotguns would primarily be employed by WS to lethally take bird species to alleviate or prevent nest predation. Rifles would primarily be used, when deemed appropriate under the proposed action alternative, to lethally take mammalian wildlife species. When using shotguns to take all crows pursuant to the blackbird depredation order, WS would only use non-toxic shot as defined in 50 CFR 20.21(j) pursuant to the requirements of the blackbird depredation order (see 50 CFR 21.43(b)).

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

Muscle samples from two species of fish collected in water bodies with high lead shot accumulations had lead levels that were well below the accepted threshold standard of safety for human consumption (Stansley et al. 1992).

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

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 is issued. The amount of lead deposited into the environment may be lowered by WS' involvement in nest predator damage management activities due to efforts by WS to ensure projectiles do no 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 are lethally removed humanely in situations that ensure accuracy and that misses occur infrequently which further reduces the potential for lead to be deposited in the soil from misses or from projectiles passing through carcasses. In addition, WS' involvement ensures carcasses lethally removed using firearms would be retrieved and disposed of properly to limit the availability of lead in the environment and ensures carcasses are 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 are 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.

Impacts of Dispersing Wildlife to other Areas

Another issue often raised is that the dispersal of wildlife from one location to alleviate nest predation could result in new damage or conflicts at a new location. The dispersal of wildlife from areas where nest predation occurs or could occur would primarily result from the use of non-lethal methods. For example, access to ground nesting colonial waterbirds is often prevented or discouraged through the use of exclusion methods (*e.g.*, fencing placed around ground nests). If a food source is made unavailable through exclusion, those nest predators attracted to the area could disperse to other areas where food sources are more readily available and easier to obtain. Those wildlife species addressed in this EA are often associated with requests for assistance associated with damage or the threat of damage occurring to property, agricultural resources, and threats to human safety (USDA 1997). Therefore, those species could be dispersed from areas where activities are being conducted to reduce or alleviate nest predation and subsequently, cause damage or pose threats in other areas.

While the original requester may see resolution to nest predation when those nest predators are dispersed, the recipient of those species may see the problem as imposed on them. Thus, on the whole, the damage is shifted from one entity to another. However, this issue would only be applicable if those nest predators

dispersed actually caused damage in another location. Since those species addressed in this EA can be found throughout the Commonwealth in appropriate habitat, those species could cause damage wherever they occur. Therefore, the dispersal of wildlife from nesting areas would not increase the likelihood that additional damage or threats of damage would occur in other areas. Given the home ranges of many of the species addressed in this EA during the time when nest predator activities would occur, the likelihood of dispersing large numbers of any individual wildlife species to the point that a higher incidence of damage could occur beyond what could occur in the absence of nest predator damage management activities is unlikely. WS has minimized the impact of dispersing wildlife by creating a management option to reduce the number of wildlife using locations that are responsible for creating the conflict.

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

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

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

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

Inability to know if an Individual of a Given Wildlife Species are Actually Nest Predators

Although it is often impossible to determine if an individual of a given nest predator species is actually depredating eggs or chicks, their very presence in the nesting area presents a real and present threat. Even if an individual is not and has not fed on eggs or chicks, it could at any time locate and exploit this available food resource. In order to minimize take of individuals that do not engage in depredating nests, WS would restrict activities to the minimum area determined to be effective at reducing predation by the nest predator species determined to be preying on eggs and chicks or at risk of depredating nests.

CHAPTER 3: ALTERNATIVES

Chapter 3 contains a discussion of the alternatives which were developed to meet the need for action discussed in Chapter 1 and to address the identified issues discussed in Chapter 2. Alternatives were developed for consideration based on the issues using the WS Decision model (Slate et al. 1992, USDA 1997). The alternatives will receive detailed environmental impacts analysis in Chapter 4 (Environmental Consequences). Chapter 3 also discusses alternatives considered but not analyzed in detail, with rationale. SOPs for nest predator damage management in Massachusetts are also discussed in Chapter 3.

3.1 DESCRIPTION OF THE ALTERNATIVES

The following alternatives were developed to meet the need for action and to address the identified issues associated with managing nest predation of colonial waterbirds in the Commonwealth:

Alternative 1 – No Nest Predator Damage Management Conducted by WS

This alternative precludes any and all activities by WS to reduce or prevent nest predation on colonial waterbirds. WS would not be involved with any aspect of nest predator damage management in the Commonwealth. All requests for assistance received by WS to reduce or prevent nest predation would be referred to the MDFW, the USFWS, other governmental agencies, and/or to private entities.

Despite no involvement by WS in resolving predation and threats of predation associated with nest predators in the Commonwealth, other entities in Massachusetts could continue to resolve damage by employing those methods legally available and permitted for use. Nest predators could continue to be lethally taken in Massachusetts pursuant to permits and in the case of crows, under the blackbird depredation order. In addition, those nest predators identified in this EA could be lethally taken during the regulated harvest seasons in the Commonwealth. All methods described in Appendix B would be available for use by those persons experiencing damage or threats except for the use of DRC-1339 and mesurol for crows which can only be used by WS.

Property owners or managers could conduct nest predator damage management using shooting, live trapping, or any non-lethal method that is legally available. In some cases, control methods employed by property owners or managers could be contrary to the intended use of some of the methods or in excess of what is necessary. Inappropriate use of some non-lethal methods may result in injury to humans, damage to property, and increased risk to non-target species. Those problems may occur because Commonwealth agencies, businesses, and organizations have less technical knowledge and experience managing wildlife damage than WS.

Alternative 2 – Nest Predator Damage Management by WS through Technical Assistance Only

Under this alternative, WS would provide those cooperators requesting assistance with managing nest predation and threats with technical assistance only. Technical assistance would provide those cooperators with information, demonstrations, and recommendations on available and appropriate methods. The implementation of methods and techniques to resolve or prevent 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 by private entities. Generally, several management strategies are described to the requester for short and long-term solutions to damage problems; those strategies are 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 recommend or loaned by WS.

The WS program regularly provides technical assistance to individuals, organizations, and other federal, Commonwealth, 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 the damage themselves. Types of technical assistance projects may include a visit to the affected property, written communication, telephone conversations, or presentations to groups such as homeowner associations or civic leagues.

Under the technical assistance only alternative, WS would recommend the use of an adaptive approach to

managing nest predation which would integrate the use of the most practical and effective methods to resolve a request for assistance as determined by either site-specific evaluations or based on information provided by the requestor. Those entities requesting assistance would be provided with information regarding the use of appropriate non-lethal and lethal techniques. WS would work with those entities requesting technical assistance in identifying those nest predators responsible for predating on ground nests as expeditiously as possible. To be most effective, damage management activities should begin prior to the arrival of ground nesting colonial waterbirds. Nest predation that has been ongoing can be difficult to resolve using available methods since those nest predators are conditioned to an area and are familiar with a particular location. Subsequently, making that area unattractive through the use of available methods can be difficult to achieve once predation has been ongoing and those nest predators associated an area as a providing a food source. WS would work closely with those entities requesting assistance to identify situations where nest predation could occur and would recommend work begin to implement wildlife damage management 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.

Lethal methods that would be available for use by those persons requesting technical assistance under this alternative include shooting and legal traps. Non-lethal methods include fencing, netting, deterrents/repellents, exclusion, harassment, habitat alteration, or live-capture and translocation, when permitted. The most appropriate response would often be a combination of non-lethal and lethal methods, or there could be instances where application of lethal methods alone would be the most appropriate strategy. For any management methods employed, the proper timing is essential in effectively dispersing those predators from areas where nesting occurs. Employing methods before nest building or soon after nest building begins increases the likelihood that those damage management 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 are employed. Non-lethal methods would be given priority when addressing requests for technical assistance (WS Directive 2.101). However, non-lethal methods would not necessarily be recommended to resolve every request for assistance if deemed inappropriate by WS' personnel using the WS Decision Model, especially if the requestor has employed non-lethal methods previously and found those methods to be inadequate in resolving predation. Non-lethal methods are used to exclude, harass, and disperse target wildlife from areas where damage or threats are occurring. When effective, non-lethal methods would disperse nest predators from the area resulting in a reduction in the presence of those mammals or birds at the site where those methods were employed.

Under this alternative, WS could recommend only non-lethal methods when determined to be appropriate for each request for assistance to alleviate nest predation through the use of the WS Decision Model. In many situations, the cooperating entity has tried to employ non-lethal methods to resolve predation and has either been unsuccessful or the reduction in predation or threats has not reached a level that is tolerable by the requesting entity. In those situations, WS could recommend other non-lethal methods, recommend that the requesting entity apply the same non-lethal methods, or recommend lethal methods.

Lethal methods could also be recommended to resolve predation associated with those species of nest predators identified by WS as responsible for predation or posing as a threat of predation through a site visit or from information provided by the requestor. The use of lethal methods by the requestor would result in local population reductions in the area where predation or threats were occurring since those nest predators would be removed from the population. Lethal methods are often employed to reinforce non-lethal methods and to remove those nest predators that have been identified as predating nests or posing a

threat of nest predation. The use of lethal methods would result in local reductions of those nest predators in the area where predation or threats were occurring. The number of nest predators removed from the population using lethal methods under this alternative would be dependent on the number of requests for technical assistance received, the number of those species involved with the associated predation or threat, and the efficacy of methods employed by those requesting assistance.

Most lethal and non-lethal methods currently available provide only short-term benefits when addressing damage associated with nest predation. Those methods are intended to reduce predation occurring at the time those methods are employed but do not necessarily ensure nest predators would not return once those methods are discontinued or at a later time when new individuals of those species occupy the available habitat. Long-term solutions to resolving nest predation are often difficult to implement and can be costly. In some cases, long-term solutions involve exclusionary devices, such as fencing, or other practices which are not costly or difficult to implement such as closing garbage cans which can act as an attractant by drawing predators into an area to feed. When addressing nest predator damage, long-term solutions generally involve modifying existing habitat or making conditions to be less attractive to those predators. To ensure complete success, alternative sites in areas where nest predation is not likely to occur are often times required to achieve complete success in reducing 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 predators to other areas where predation could occur or could result in multiple occurrences of nest predation.

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. Managing nest predator populations over broad areas could lead to a decrease in the number of those species. Establishing hunting or trapping seasons and the allowed take during those seasons is the responsibility of the MDFW. WS does not have the authority to establish hunting or trapping seasons or to set allowed harvest numbers during those seasons.

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 recommended by WS to resolve requests for assistance nor does the listing of methods imply that all methods would be recommended to resolve every request for assistance. WS' programmatic FEIS contains additional discussion on adaptive management using an integrated approach to address damage to resources that could be recommended under this alternative (USDA 1997). Similar to Alternative 1, those methods described in Appendix B would be available to those entities conducted nest predator damage management except for DRC-1339 and mesurol which are available to reduce crow predation and can only be used by WS.

Those entities concerned with nest predation could seek direct operational assistance from other governmental agencies, private entities, or conduct damage management on their own. This alternative would place the immediate burden of operational damage management work on the resource owner and/or other governmental agencies. Those entities could implement a nest predator damage management program using those methods legally available listed in Appendix B or could take no action. In situations where non-lethal methods have been 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 have to apply for their own permit to take mammalian species from the MDFW, if required, or when certain conditions are met, the use of lethal methods could be employed pursuant to the blackbird depredation order to take crows. Under this alternative, those nest predators identified in this assessment could be lethally taken during the annual harvest seasons for those species. Property owners or managers could take action using those methods legally available to resolve or prevent nest predation as permitted by federal, Commonwealth, 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, to reduce nest predation in Massachusetts. A major goal of the program would be to resolve and prevent nest predation on colonial ground nesting waterbirds when requested. To meet this goal, WS would continue to respond to requests for assistance with, at a minimum, technical assistance, or when funding is available, operational damage management. Funding could occur through federal appropriations or from cooperative funding.

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

As part of an integrated approach to managing nest predation, WS could provide technical assistance and/or direct operational assistance when requested. Technical assistance would occur as described in Alternative 2 of this EA. Technical assistance is also further discussed in WS' programmatic FEIS (USDA 1997). Direct operational assistance includes damage management activities that are directly conducted by or supervised by personnel of WS. Operational damage management assistance may be initiated when the problem cannot effectively be resolved through technical assistance alone and when a written MOU, cooperative service agreement, or other comparable document exists between WS and the entity requesting assistance. The initial investigation into the requests for assistance defines the nature, history, and extent of the problem; species responsible for the damage; and methods available to resolve the problem.

Methods available for use to those entities provided technical assistance under this alternative would be the same methods available under Alternative 2. Non-lethal methods include, but are not limited to: habitat/behavior modification, supplemental food sources, visual deterrents, live traps, foothold traps, exclusionary devices, frightening devices, chemical immobilization, and chemical repellents (see Appendix B for a complete list and description of potential methods). Lethal methods considered by WS include: live-capture followed by euthanasia, the recommendation of take during hunting seasons, DRC-1339, cable restraints, body-gripping traps, and shooting. However, listing methods neither implies that all methods would be used or recommended by WS to resolve requests for assistance nor does listing of methods imply that all methods would be used to resolve every request for assistance. Some trapping methods may only be available for use on federal lands due to Massachusetts restrictions on trap types (see Section 1.6).

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 would be to implement lethal methods, if determined to be appropriate using the WS Decision Model.

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

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

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

Under this alternative, WS would be required to implement non-lethal methods only to resolve nest predation when a request for assistance is received. Only those methods discussed in Appendix B that are considered non-lethal would be employed by WS. No lethal take of mammals would occur by WS. The use of lethal methods could continue to be used under this alternative by those persons in areas where nest predation occurs. The non-lethal methods used or recommended by WS under this alternative would be identical to those identified in any of the alternatives except the repellent mesurol would only be available for use by WS' personnel.

In situations where non-lethal methods were impractical or ineffective to alleviate damages, WS could refer requests for information regarding lethal methods to the MDFW, local animal control agencies, or private businesses or organizations. However, property owners/managers might be limited to using non-lethal methods only if assistance to not provided by those entities.

Under this alternative, non-lethal methods would include fencing, netting, deterrents/repellents, exclusion, harassment, habitat alteration, and live-capture and translocation. The chemical repellent mesurol would 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.

Nest predators live-captured could be live-captured and translocated under this alternative since lethal methods would be unavailable. 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.

Requests for information regarding lethal management approaches would be referred to other

governmental agencies or private entities. Property owners or managers could still resort to legal lethal methods or other methods not recommended by WS, use contractual services of private businesses that were available to them, or take no action.

3.2 ALTERNATIVES CONSIDERED BUT NOT ANALYZED IN DETAIL WITH RATIONALE

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

Non-lethal Methods Implemented Before Lethal Methods

This alternative would require that all non-lethal methods or techniques described in Appendix B be applied to all requests for assistance to reduce nest predation. If the use of all non-lethal methods fails to resolve predation at each damage situation, lethal methods would be employed to resolve the request. Non-lethal methods would be applied to every request for assistance regardless of severity or intensity of 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.

Those persons experiencing damage often employ non-lethal methods to reduce damage or threats prior to contacting WS. Verification of the methods used would be the responsibility of WS. No standard exists to determine requester diligence in applying those methods, nor are there any standards to determine how many non-lethal applications are necessary before the initiation of lethal methods. Thus, only the presence or absence of non-lethal methods can be evaluated. The proposed action (Alternative 3) is similar to a non-lethal before lethal alternative because the use of non-lethal methods is considered before lethal methods by WS (WS Directive 2.101). Adding a non-lethal before lethal alternative and the associated analysis would not add additional information to the analyses in the EA.

Use of 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 damage in certain instances. Under WS Directive 2.101, WS must consider the use of non-lethal methods before lethal methods. Non-lethal methods have been effective in alleviating nest predation, especially exclusion placed around ground nests. In those situations where damage could be alleviated using non-lethal methods deemed effective, those methods would be employed or recommended as determined by the WS Decision Model. Therefore, this alternative was not considered in detail.

Trap and Translocate Mammals 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 captured alive in cage traps and foothold traps. Foothold traps would only be used on federal property. All nest predators live-captured through direct operational assistance by WS would be translocated. Translocation sites would be identified and have to be approved by the MDFW 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, the translocation of nest predators could only occur under the authority of the MDFW and in the case of crows, 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 Commonwealth

unless permitted by the MDFW under CMR 2.15 and the USFWS, this alternative was not considered in detail since translocation of nest predators by WS could occur under any of the alternatives analyzed in detail, except Alternative 1 and Alternative 2.

The translocation of target species to other areas following live-capture that have caused damage generally would not be effective or cost-effective. Translocation is generally ineffective because target species are highly mobile and can easily return to damage sites from long distances, habitats in other areas are generally already occupied, and translocation would most likely result in damage problems at the new location. 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.

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

Population modeling indicates that reproductive control is more efficient than lethal control only for some rodent and small bird species with high reproductive rates and low survival rates (Dolbeer 1998).

Additionally, the need to treat a sufficiently large number of target animals, multiple treatments, and population dynamics of free-ranging populations place considerable logistic and economic constraints on the adoption of reproduction control technologies as a wildlife management tool for some species. Currently, no reproductive inhibitors are available for use to manage most mammal and bird 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 becomes available to manage a large number of wildlife populations and has proven effective in reducing localized populations, the use of the inhibitor could be evaluated under the proposed action as a method available that could be used in an integrated approach to managing damage. This EA would be reviewed and supplemented to the degree necessary to evaluate the use of the reproductive inhibitor as part of an integrated approach described under the proposed action and the other alternatives.

Short Term Eradication and Long Term Population Suppression

An eradication alternative would direct all WS' program efforts toward total long term elimination of nest predator populations on property where ground nesting colonial waterbirds occurs. Eradication of native wildlife species is not a desired population management goal of natural resources agencies or WS. Eradication as a general strategy for managing predation will not be considered in detail because all Commonwealth 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 WS' program efforts toward managed reduction of certain problem populations or groups. In areas where damage can be attributed to localized populations of nest predators, WS can decide to implement local population suppression as a result of using the WS' Decision Model. It is not realistic or practical to consider large-scale population suppression as the basis of the WS' program. Problems with the concept of suppression are similar to those described above for eradication. Typically, WS' activities in the Commonwealth 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 Commonwealth 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, including

- Bounties are generally ineffective at controlling predation, especially over a wide area such,
- Circumstances surrounding the take of animals are typically arbitrary and completely unregulated,
- It is difficult or impossible to assure animals claimed for bounty were not taken from outside the damage management area, and
- WS does not have the authority to establish a bounty program.

Use of Non-lethal methods Only, Except for Chemical Methods

Under this alternative, WS would be required to implement non-lethal methods only to resolve nest predation, with the exception of chemical methods. Only those methods discussed in Appendix B that are considered non-lethal would be employed by WS, with the exception of rodenticides, avicides or avian repellents such as Avitrol or mesurol which may be lethal to some of the individuals that consume treated baits. The use of lethal methods could continue to be used under this alternative by those persons in areas where nest predation occurs. The non-lethal methods used or recommended by WS under this alternative would be identical to those identified in any of the alternatives.

3.3 STANDARD OPERATING PROCEDURES

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

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

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

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

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

- Drugs are used according to the DEA, FDA, and WS' program policies and directives and procedures are followed that minimizes pain.

- All controlled substances are registered with DEA or 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).

- WS' employees that use controlled substances are trained to use each material and are certified to use controlled substances under the Agency certification program.

- Pesticide and controlled substance use, storage, and disposal conform to label instructions and other applicable laws and regulations, and Executive Order 12898.

- Material Safety Data Sheets for pesticides and controlled substances are provided to all WS' personnel involved with specific damage management activities.

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

- The take of nest predators would only occur when authorized by the MDFW, when applicable, and only at levels authorized.

- WS has consulted with the USFWS to ensure program activities would not likely adversely affect T&E species.

- WS has consulted with the MDFW to ensure program activities would not adversely affect state-listed Endangered, Threatened, and Special Concern species.

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

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

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

- Management actions are directed toward specific wildlife that are or likely would feed on eggs, nestlings, or adults of ground nesting colonial waterbirds. Generalized population suppression

across the Commonwealth, or even across major portions of Massachusetts, would not be conducted.

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

3.4 ADDITIONAL STANDARD OPERATING PROCEDURES SPECIFIC TO THE ISSUES

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

- Lethal take of nest predators by WS would be reported and monitored by WS, by the MDFW, and by the USFWS annually to evaluate population trends and the magnitude of WS' take of those species in the Commonwealth.

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

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

- WS would annually monitor nest predator damage management activities to ensure activities do not adversely affect populations of those species in the Commonwealth.

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

Issue 2 - Effects of Damage Management 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 impacts.

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

- 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.

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

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

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

Issue 3 – Effects of Damage Management Activities on Threatened and Endangered Species

- WS has consulted with the USFWS and the MDFW to evaluate activities to resolve nest predation and threats to ensure the protection of T&E species.

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

- When conducting nighttime activities and when possible, WS would employ night vision equipment, infrared devices, or red filtered spotlights to identify target species.

- When requested and whenever possible, WS would conduct direct operational assistance prior to the arrival of T&E species at nesting locations.

- Human presence at control sites would be kept to the minimal 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.

Issue 4 - Effectiveness of Nest Predator Damage Management

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

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

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

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

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

- All personnel employing chemical methods would be properly trained and certified in the use of those chemicals. All chemicals used by WS would be securely stored and properly monitored to ensure the safety of the public. WS' use of chemicals and training requirements to use those chemicals are outlined in WS Directive 2.401 and WS Directive 2.430 along with WS Directive 2.465.

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

- Carcasses of nest predators retrieved after damage management activities 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 the damage or identified as posing a threat of nest predation.

- All methods or techniques applied to resolve nest predation would be agreed upon with the appropriate land owner or manager by entering into a cooperative service agreement, MOU, or comparable document prior to the implementation of those methods.

- Preference is given to non-lethal methods, when practical and effective under WS Directive 2.101. If practical and effective non-lethal control methods are not available, have already being employed, or have been attempted but were ineffective and if lethal control methods are available and appropriate for WS to implement, WS may implement lethal methods.

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 is addressed promptly to minimize that amount of time an animal is restrained.

- WS' use of euthanasia methods would follow those recommended by WS' directives (WS Directive 2.505) and the AVMA (AVMA 2007).

- The NWRC is 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 is considered prior to the use of lethal methods when managing nest predation.

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

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

- WS' activities to manage damage and threats caused by nest predators would be coordinated with and conducted under permits issued by the USFWS and/or the MDFW.

- WS' lethal take (killing) of mammalian nest predators would be reported to and monitored by the MDFW to ensure WS' take is considered as part of management objectives for those species in

the Commonwealth. The lethal take of crows would be reported annually to the USFWS to ensure the take of American crows and fish crows occurs within population objectives.

- WS would annually monitor nest predator damage management activities to ensure activities do not adversely affect the populations of those nest predators in the Commonwealth.

Issue 9 - Effects on Recreation in Areas Where Damage Management Activities Are Conducted

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

- Most activities would be conducted away from areas of high human activity. If this is not possible, then activities would be conducted during periods when human activity is low (*e.g.*, early morning).

- Nest predator damage management activities would occur approximately two months prior to the arrival of ground nesting colonial waterbirds to the end of nesting season.

- Since access to many areas where nesting colonial waterbirds occurs in severely restricted or prohibited by the property manager to prevent disturbance of nesting waterbirds, nest predator damage management 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 Commonwealth are not expected to be significantly impacted by any of the alternatives analyzed: soils, geology, minerals, water quality/quantity, flood plains, wetlands, critical habitats (areas listed in T&E species recovery plans), visual resources, air quality, prime and unique farmlands, aquatic resources, timber, and range. Those resources will not be analyzed further. The activities proposed in the alternatives would have a negligible effect on atmospheric conditions including the global climate. Meaningful direct or indirect emissions of greenhouse gases would not occur as a result of any of the proposed alternatives. Those alternatives would meet the requirements of applicable laws, regulations, and Executive Orders including the Clean Air Act and Executive Order 13514.

4.1 ENVIRONMENTAL CONSEQUENCES FOR ISSUES ANALYZED IN DETAIL

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

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

A common issue is whether damage management actions would adversely affect the viability of the target species' population. Wildlife species identified as nest predators in this assessment which are considered target wildlife species include Virginia opossum, Norway rats, coyotes, red fox, gray fox, raccoons, fisher, short-tailed weasels, long-tailed weasels, mink, striped skunks, bobcats, feral cats, American crows

and fish crows. Most of those wildlife species are considered a harvestable in the Commonwealth with annual hunting and/or trapping seasons occurring in Massachusetts. Crows can be harvested in the Commonwealth under frameworks established by the USFWS and implemented in the Commonwealth by the MDFW. In addition, those target species can be lethally taken through the issuance of permits and in the case of crows, through depredation orders established by the USFWS. Therefore, the take of those target wildlife species can occur during annual hunting and trapping seasons and under depredation orders that allow those species to be taken to alleviate damage and threats of damage.

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.

Generally, WS only conducts damage management on species whose population densities are high and usually only after they have caused damage. WS' take is monitored by comparing numbers of animals killed with overall populations or trends in populations to assure the magnitude of take is maintained below the level that would cause undesired adverse affects to the viability of native species populations (USDA 1997).
WS maintains ongoing contact with the USFWS and the MDFW and submits annual migratory bird activity reports to the USFWS and annual take reports to the MDFW. The USFWS monitors the total take of crows from all sources and factors in survival rates from predation, disease, and other mortality data. Similarly, the MDFW monitors the take and populations of those target species in the Commonwealth. Ongoing contact with USFWS and the MDFW assures local, Commonwealth, and regional knowledge of wildlife population trends are considered. As discussed previously, the need for action discusses the predation of eggs, nestlings, and adults of ground nesting colony waterbirds by those target species. The issue of the potential impacts of conducting the alternatives on the populations of target wildlife species is analyzed for each alternative below.

Alternative 1 – No Nest Predator Damage Management Conducted by WS

Under this alternative, WS would not conduct nest predator damage management activities in the Commonwealth. 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 Commonwealth. Those nest predators identified could continue to be lethally taken to resolve predation and/or threats occurring through the issuance of permits by the MDFW. 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 Commonwealth during annual trapping seasons. Crows could still be lethally taken under the depredation order to alleviate nest predation in the Commonwealth. 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 lethal damage management resulting in potential impacts similar to the proposed action.

Since the take of nest predators by those persons experiencing damage 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 MDFW, the potential effects on the populations of

those nest predators in the Commonwealth would be similar among all the alternatives for this issue. Since WS' involvement in nest predator damage management would only occur after the MDFW has issued a permit for such action for the take of mammalian nest predators, when required, WS' involvement would not be additive to take that could occur since the cooperator requesting WS' assistance could conduct nest predator damage management activities without WS' direct involvement, if permitted. Therefore, any actions to resolve nest predation or reduce threats associated with nest predators could occur by other entities despite WS' lack of involvement under this alternative.

Alternative 2 – Nest Predator Damage Management by WS through Technical Assistance Only

Populations of target wildlife species in the Commonwealth would not be directly impacted by WS from a program implementing technical assistance only. However, persons experiencing damage or threats from nest predators 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 are likely those people that would implement damage abatement methods in the absence of WS' recommendations. As with the other alternatives, with the exception of a property owner or tenant, a permit from the MDFW would be required to lethally take mammalian nest predators outside of the regulated hunting and trapping season where hunting and/or trapping licenses would be required. The take of American crows and fish crows can occur under the depredation order for blackbirds and therefore, a depredation permit from the USFWS is not required to take crows outside of the hunting season when a hunting license would be required. Similarly, the take of crows outside of the hunting season can occur without the need for a depredation permit from the MDFW.

Under a technical assistance only alternative, those persons experiencing threats or damage associated with nest predators could apply for a permit from the MDFW to lethally take mammalian nest predators despite WS' lack of direct involvement in the management action. In addition, the take of crows could occur under the blackbird depredation order when the criteria for the order have been met. Therefore, 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, 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 MDFW and the USFWS, it is unlikely that nest predator populations would be adversely impacted by implementation of this alternative. Under this alternative, WS would not be directly involved with damage management actions and therefore, direct operational assistance could be provided by other entities, such as the MDFW, USFWS, municipal authorities, and/or private entities. Therefore, the take of those nest predators identified is 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 Commonwealth. WS would employ those methods described in Appendix B in an adaptive approach that would integrate methods to effectively reduce damage and threats associated with 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 damage and threats are categorized into non-lethal and lethal methods. As part of an integrated approach to managing damage and threats, WS could apply both lethal and non-lethal methods when requested by those persons who own or manage property where nest predation has occurred or could occur.

Non-lethal methods can disperse or otherwise make an area unattractive to wildlife causing damage; thereby, reducing the presence of those species at the site and potentially the immediate area around the site where non-lethal methods are employed. Non-lethal methods would be given priority when addressing requests for assistance (WS Directive 2.101). However, non-lethal methods would not necessarily be employed to resolve every request for assistance if deemed inappropriate by WS' personnel using the WS Decision Model. For example, if a cooperator requesting assistance, has already attempted to alleviate nest predation using non-lethal harassment methods, WS would not necessarily employ those methods again during direct operational assistance since those methods have already been proven to be ineffective in that particular situation. Non-lethal methods are used to exclude, harass, and disperse target wildlife from areas where damage or threats are occurring. When effective, non-lethal methods would disperse target wildlife from the area resulting in a reduction in the presence of those wildlife species at the site where those methods were employed. However, those individuals of a wildlife species responsible for causing damage or threats are moved to other areas with minimal impact on the statewide population. Non-lethal methods are not employed over large geographical areas or applied at such intensity that essential resources (*e.g*., breeding locations, food sources) would be unavailable for extended durations or over a wide geographical scope that long-term adverse affects would occur to a species' population. Non-lethal methods are generally regarded as having minimal impacts on overall populations of wildlife since those species are unharmed. The use of non-lethal methods would have no adverse impacts on target wildlife populations in the Commonwealth.

Lethal methods could be employed to resolve damage associated with those target wildlife identified by WS as responsible for feeding on eggs, nestlings, and/or adults of ground nesting waterbirds only after receiving a request for such assistance and only after a permit has been issued for the take of wildlife species by the MDFW, when required. The use of lethal methods would therefore result in local population reductions in the area where nest predation or threats of predation were occurring since target wildlife would be removed from the population. Lethal methods are often employed to reinforce non-lethal methods and to remove those individuals that have been identified as causing damage or posing a threat of damage. The use of lethal methods would therefore result in local reductions of nest predators in the area where damage 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 are involved with the associated damage or threat, and the efficacy of methods employed.

Virginia Opossum Population Information and Effects Analysis

Opossums are the only marsupials (*i.e*., 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*b*). They are also found in parts of the southwestern United States, California, Oregon, and Washington (Jackson 1994). Adults 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 fairly broad range of pelage colors, but 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, and berries and other fruits; persimmons, apples, and corn are favorite foods (National Audubon Society 2000*b*). They use a home

range of four to 20 hectares (10-50 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 1-17 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*b*). Those young remain in the pouch for about two months at which time they will begin to explore and may be found traveling on their mother's back with their tails grasping hers (Whitaker, Jr., and Hamilton, Jr. 1998). Opossums live for 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, it was 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 miles in mixed pasture and woodlands in Iowa. However, VanDruff (1971) found opossum densities in waterfowl nesting habitat as high as 259 opossum per square miles.

Opossum are common throughout Massachusetts in appropriate habitat except for Dukes and Nantucket Counties. Opossums are a furbearer species as defined by the Code of Massachusetts Regulations, (321 CMR 3.02(3); M.G.L. c. 131, § 5) and may be legally hunted and trapped in Massachusetts. In addition, the Code of Massachusetts Regulations (M.G.L. c. 131, § 37) states that "*an owner or tenant of land or, if authorized by such owner or tenant, any member of his immediate family or his employee*...[can] *hunt or take by other means, except by poison or snare, any mammal found damaging property*...". In addition "[n]*o such owner or tenant shall authorize any person, other than a member of his immediate family or a person permanently employed by him, to place traps for the protection of said property other than during the open season, unless such owner or tenant has first obtained from the director a permit authorizing him so to do, which permit the director is hereby authorized to issue in his discretion, unless such authorized person holds a trapping license*." Opossums may also be taken by licensed Problem Animal Control Agents.

Opossums may also be removed without a permit if an immediate threat exists to human life while public safety officials including animal control officers, police departments, and the Massachusetts Environmental Police, have the authority to respond and dispatch the animal, as stipulated in the Code of Massachusetts Regulations (CMR 2.14) that pertains to handling problem animals.

Population estimates for opossum in the Commonwealth are not available. Therefore, a population estimate will be derived based on the best available information for opossum to provide an indication of the magnitude of take proposed by WS to alleviate predation on nests of colonial waterbirds. The Commonwealth of Massachusetts covers 10,555 square miles with 7,838 square miles being land area. If opossum were only found on 50% of the land area of the Commonwealth and using a mean density of 10.1 opossum per square mile found by Seidensticker et al. (1987) in Virginia, the population would be estimated at nearly 39,600 opossum. Using the range of opossum found by Seidensticker et al. (1987) estimated at 1.3 opossum per square mile to 20.2 opossum per square mile and only 50% of the land area of the Commonwealth being occupied by opossum, the statewide population would range from a low of 5,100 opossum to a high of nearly 79,200 opossum. Opossum can be found in a variety of habitats, including urban areas, so opossum occupying only 50% of the land area of the Commonwealth is unlikely since opossum can be found almost statewide. However, opossum occupying only 50% of the land area was used to provide a minimum population estimate to determine the magnitude of the proposed take by

WS to alleviate or prevent nest predation.

As stated previously, opossum are considered a furbearing species in the Commonwealth and can be harvested during annual hunting and trapping seasons. During the development of the EA, opossum could be harvested during hunting and trapping season with no limit on the number that could be taken during those seasons. In addition, opossum can be lethally taken in the Commonwealth when causing damage or posing a threat of damage when permitted by the MDFW. The number of opossum harvested during the annual hunting and trapping seasons within the Commonwealth is estimated based on trapper and hunter surveys. Opossums are also lethally taken to alleviate damage or threats of damage; however, the number of opossums lethally taken annually in the Commonwealth to alleviate damage or threats of damage is currently unknown because PAC agent annual take reports have not been compiled.

Between FY 2006 and FY 2010, WS has lethally taken a total of four opossum in the Commonwealth to alleviate damage or threats of damage. All take occurred in FY 2009 when four opossum were lethally taken using firearms to alleviate predation threats to T&E species. Between 2006 and 2009, a total of 172 opossum have been reported as harvested during the hunting and trapping season in the Commonwealth. The highest level of reported take occurred in 2007 when 79 opossum were reported harvested. During the 2009 hunting and trapping season, a total of 30 opossum were reported as lethally taken in the Commonwealth. WS' take of four opossum in FY 2009 would represent 13.3% of the reported harvest of opossum during 2009 in the Commonwealth.

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 a total of 50 opossum annually in the Commonwealth as part of efforts to reduce nest predation and during activities to alleviate aircraft strikes in the Commonwealth (USDA 2002). Therefore, the cumulative take of opossum by WS would not exceed 50 oppossum annually to alleviate nest predation and threats occurring at airports. Given the range of population estimates in the Commonwealth, the take of 50 opossum by WS annually would represent from 0.1% to 1.0% of the estimated statewide population if the overall population remains at least stable. Although the number of opossum actually lethally taken in the Commonwealth during the annual hunting and trapping seasons and for damage management is unknown, the cumulative take of opossum, including the proposed cumulative take of up to 50 opossum annually by WS, would not reach a magnitude where adverse affects would occur to the statewide opossum population. The permitting of the take by the MDFW, which has management authority of wildlife species in the Commonwealth, ensures the cumulative take of opossum occurs within allowable take levels to achieve the desired population levels.

Norway Rat Population Information and Effects Analysis

The Norway rat is a stocky burrowing rodent, unintentionally introduced into North America. Adult Norway rats weigh an average of 454 g (1 lb). Their fur is coarse and usually brownish or reddish gray above and whitish gray on the belly. Blackish individuals occur in some locations. They make a network of interconnecting tunnels for nesting and they are a colonial species. They may burrow to make nests under buildings and other structures, beneath concrete slabs, along stream banks, around ponds, in garbage dumps, and at other locations where suitable food, water, and shelter are present (Timm 1994).

They live in close association with people (Burt and Grossenheider 1976, Timm 1994, National Audubon Society 2000*b*), and in urban areas they live in and around residences, in cellars, warehouses, stores, slaughterhouses, docks, and sewers. On farms they may inhabit barns, granaries, livestock buildings, silos, and kennels (Timm 1994). In summer they may inhabit cultivated fields (National Audubon Society 2000*b*). Norway rats are found throughout the U.S. and southern Canada and on the Pacific coast north to Alaska. They may be found in this range wherever humans live (Timm 1994, National Audubon

Society 2000*b*). They are primarily nocturnal and usually become active about dusk, when they begin to forage for food and water. Some individuals may be active during daylight hours when rat populations are high. They have poor eyesight, relying more on hearing and the senses of smell, taste and touch. They are considered color blind (Timm 1994).

Norway rats will eat nearly any type of food. When given a choice they will select a nutritionally balanced diet, choosing fresh, wholesome items over stale or contaminated food. They prefer cereal grains, meats and fish, nuts, and some types of fruit. Food items in household garbage offer a fairly balanced diet and also satisfy their water requirements (Timm 1994). Rats often contaminate food they do not eat with droppings. They eat wild plants, insects, and seeds (National Audubon Society 2000*b*).

Norway rats breed year-round (National Audubon Society 2000*b*) but peaks occur in spring and fall. Reproductive activity typically declines during the heat of summer and often stops completely in winter, depending on habitat. The average female rat has 4-6 litters per year with 2-22 young per litter (Timm 1994, National Audubon Society 2000*b*). Twelve litters per year are possible (Burt and Grossenheider 1976, National Audubon Society 2000*b*). Gestation is 21-26 days. Female rats may breed again within one to two days after a litter is born (Timm 1994).

The statewide population of Norway rats is unknown and the number of rats taken annually to alleviate damage in the Commonwealth is also unknown. Rats can be lethally taken throughout the year in the Commonwealth with no regulations on the number that can be lethally taken. WS has not previously been requested to address predation caused by Norway rats in the Commonwealth. However, rats can be found statewide in Massachusetts and are known to occur in nesting areas. Rats are also known to be opportunistic foragers and are known to predate eggs. When requested, WS would only conduct nest predator damage management activities in isolated areas where predation has occurred or could occur.

Based on previous activities to address predation associated with nest predators, WS could lethally take up to 200 rats per year in efforts to reduce predation on ground nesting birds along with efforts to reduce wildlife strikes at airports within the Commonwealth (USDA 2002). The cumulative take of up to 200 rats to alleviate nest predation and to reduce threats occurring at airports in the Commonwealth would be of low magnitude given the reproductive potential associated with rats, the statewide distribution, and the likelihood of a very high population in the Commonwealth. Since rats often compete with native wildlife for resources, any reduction in the local rat population would likely benefit native species, including ground nesting bird species.

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*b*). Color varies greatly from 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). Coyotes sometimes breed with domestic dogs producing hybrids called "*coydogs*" (National Audubon Society 2000*b*). The size of coyotes averages from about 20 to 40 lbs (9 – 18 kg) (Novak et al. 1987) although individuals over 50 lbs are taken in Massachusetts (T. Cozine, WS pers. comm. 2011).

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 from 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 dump sites 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 0-80% in different populations (Gier 1968). This variation is influenced by a number of factors, but causes large annual variation in total number of coyotes breeding. In a study in Texas, the percentage of females having litters varied from 48-81% (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*b*).

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 $2/km^2$ ($5/mi^2$) 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) published 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.

Coyotes in Massachusetts are well established statewide, with the exception of Martha's Vineyard and Nantucket, originally moving into the central and western regions of Massachusetts in the 1950s. The coyote expanded into the eastern sections of Massachusetts and Cape Cod in the 1970s. Current population trends provided by the MDFW in 2004 indicate an increasing trend in the coyote population. No population estimates were available for coyotes in Massachusetts. If coyotes only occupy 50% of the land area of Massachusetts and the density of coyotes in the Commonwealth ranges from 0.5 coyotes per square mile to 1.0 coyotes per square mile, the statewide population could be estimated to range from nearly 2,000 coyotes to a high of nearly 4,000 coyotes.

Coyotes can be harvested during annual hunting and trapping seasons during which there is no limit to the number of coyotes that can be harvested daily or possessed during the length of the season. The number of coyotes reported as harvested from 2006 through 2009 is shown in Table 4-1. As with other furbearing species, the reporting of coyote take is voluntary and represents a minimum number of coyotes harvested. Coyotes are also known to be taken to alleviate damage and threats of damage; however, the number of coyotes lethally taken annually to alleviate damage or threats of damage is currently unknown.

Table 4-1: Known cumulative take of coyotes in Massachusetts, 2006-2010

Year	Harvest Take[1,2]	WS' Take[3]	Total
2006	242	6	**248**
2007	532	11	**543**
2008	513	13	**526**
2009	599	32	**631**
2010	N/A[†]	31	**N/A**
TOTAL	**1,886**	**93**	**1,948**

[1]Harvest take includes those coyotes reported as harvested during the hunting season and/or the trapping season and includes coyotes salvaged with pelts sealed by the Commonwealth

[2]Reported by season; for example, the 2006 entry covers the hunting and trapping season that began in 2006 and ended in 2007 since season often carry over from one calendar year to another with seasons general beginning in the fall and ending in late-winter

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

[†]N/A = Information is currently unavailable

Between 2006 and 2009, a total of 1,886 coyotes have been reported as lethally taken in the Commonwealth. The highest level of take occurred in 2009 when 599 coyotes were reported taken. As shown in Table 4-1, WS has lethally taken a total of 93 coyotes in the Commonwealth from FY 2006 through FY 2010 with the highest level of take occurring in FY 2009 when 32 coyotes were taken to alleviate damage. WS' total take from FY 2006 through FY 2009 represents 3.2% of the total known take of coyotes in the Commonwealth from 2006 trhough 2009.

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 75 coyotes total annually to alleviate nest predation along with take to reduce threats of aircraft strikes at airports (USDA 2002). Using a statewide coyote population ranging from 2,000 to 4,000 coyotes, the take of up to 75 coyotes annually would represent from 1.9% to 3.8% of the estimated population. Although exact population estimates for coyotes in Massachusetts are not available, unlimited take limits allowed by the MDFW for the species during hunting and trapping seasons indicates the species is not at risk of overharvesting. The highest reported take of coyotes in the Commonwealth during hunting and trapping seasons occurred in 2009 when 599 coyotes were reported harvested which represents the minimum harvest since reporting of take is not required. The take of up to 75 coyotes by WS would have represented 12.5% of the highest total reported harvest of coyotes.

Red Fox Population Information and Effects Analysis

The red fox is a typically proportioned member of the dog 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 from 3.5 kg to 7 kg (7.7 - 15.4 lbs.), with males averaging about 1 kg (2.2 lbs) which is heavier than females. Generally, adult fox measure 100 to 110 cm (39 - 43 inches) from the tip of the nose to the tip of the tail. Juveniles in their first autumn are as large as adults (Voigt 1987). They occur over most of North America, north and east from southern California, Arizona, and central Texas. They are found throughout most of the United States with the exception of a few isolated areas. Prehistoric fossil records suggest that the red fox may not have inhabited much of the United States, but were plentiful in many parts of Canada. However, it has been suggested that climatic factors,

interbreeding with the introduced European red fox, extirpation of the wolves, and clearing of land for agriculture has possibly contributed to the present-day expansion and range of this species in North America (Voigt 1987).

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 occurs where woodlands are interspersed with farmlands. The range of the species has expanded in recent years to fill habitats formerly occupied by coyotes. The reduction of coyotes in many sagebrush/grassland areas of Montana and Wyoming has resulted in increased fox numbers. 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 through 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*b*). 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 1 to 19 pups have been reported (National Audubon Society 2000*b*). 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*b*).

The density of red fox populations is difficult to determine because of the animals secretive and elusive nature. 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). In Great Britain, where food is abundant in many urban areas, densities as high as 30 fox/km^2 (78/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/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.

Red fox can be found statewide in Massachusetts except for Martha's Vineyard and Nantucket. Populations of red fox are considered stable in the Commonwealth (L. Hajduk, MDFW pers. comm. 2011). Based on an assumption that red fox only occupy 50% of the land area of Massachusetts and the

density of red fox in the Commonwealth is 2.6 red fox per square mile, the statewide population could be estimated at nearly 10,200 red fox.

Red fox can be harvested during annual hunting and trapping seasons during which there is no limit to the number of fox that can be harvested daily or possessed during the length of the season. The number of red fox reported as harvested from 2006 through 2009 is shown in Table 4-2. As with other furbearing species, the reporting of red fox take is voluntary and represents a minimum number of red fox harvested. Red fox are also known to be taken to alleviate damage and threats of damage; however, the number of fox lethally taken annually to alleviate damage or threats of damage is currently unknown.

Between 2006 and 2009, a total of 178 red fox have been reported as lethally taken in the Commonwealth. The highest level of take occurred in 2009 when 53 fox were reported taken. As shown in Table 4-2, WS has lethally taken a total of 64 red fox in the Commonwealth from FY 2006 through FY 2010 with the highest level of take occurring in FY 2010 when 20 red fox were taken to alleviate damage.

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 50 red fox total annually to alleviate nest predation along with take to reduce threats of aircraft strikes at airports (USDA 2002). Using a statewide coyote population at 10,200 red fox, the take of up to 50 red fox annually would represent 0.5% of the estimated population.

Table 4-2: Known cumulative take of red fox in Massachusetts, 2006-2010

Year	Harvest Take[1,2]	WS' Take[3]	Total
2006	46	10	**56**
2007	48	6	**54**
2008	31	14	**45**
2009	53	14	**67**
2010	N/A[†]	20	**N/A**
TOTAL	**178**	**64**	**222**

[1]Harvest take includes those red fox reported as harvested during the hunting season and/or the trapping season and includes red fox salvaged with pelts sealed by the Commonwealth.

[2]Reported by season; for example, the 2006 entry covers the hunting and trapping season that began in 2006 and ended in 2007 since season often cover over from one calendar year to another with seasons general beginning in the fall and ending in late-winter

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

[†]N/A = Information is currently unavailable

Although exact population estimates for red fox in Massachusetts are not available, unlimited take limits allowed by the MDFW for the species during hunting and trapping seasons indicates the species is not at risk of overharvesting. Despite previous levels of take, the red fox population appears to be at least stable which provides an indication that the cumulative take of red fox has not reached a level where declining trends have been observed. Similar to coyotes, exact population estimates for red fox in Massachusetts are not available; however, unlimited take limits allowed during annual hunting and trapping seasons by the MDFW for the species indicates the species is not at risk of overharvesting.

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. Gray fox are 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 from 3 to 7 kg (6.5 - 15 lbs), with males being slightly larger than females. Generally, adult gray fox measure 80 to 113 cm (31.5 - 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, swamp land, 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 - March and produce litters of 1-7 kits after a gestation period of 53 days (National Audubon Society 2000*b*). They rear young in a maternity den, commonly located in wood piles, 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*b*).

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 those based on recognized methods such as mark-recapture studies. Published estimates of gray fox density vary from 1.2 - 2.1 / km^2 (3.1 - 5.4 / mi^2) 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, however (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 more omnivorous than other 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*b*).

Gray fox can be found statewide in Massachusetts except for Martha's Vineyard and Nantucket. Populations of gray fox are considered stable in the Commonwealth (L. Hajduk, MDFW pers. comm.

2011). If gray fox only occupy 50% of the land area of Massachusetts and the density of gray fox in the Commonwealth is 3.1 gray fox per square mile, the statewide population could be estimated at nearly 12,200 gray fox. Gray fox can be found in a variety of habitats, including urban areas, so gray fox occupying only 50% of the land area of the Commonwealth is unlikely since fox can be found almost statewide. However, similar to the other furbearing species, gray fox occupying only 50% of the land area was used to provide a minimum population estimate to determine the magnitude of the proposed take by WS to alleviate or prevent nest predation.

Gray fox can be harvested during annual hunting and trapping seasons during which there is no limit to the number of fox that can be harvested daily or possessed during the length of the season. Between 2006 and 2009, a minimum of 169 gray fox were harvested in the Commonwealth during hunting and trapping seasons. The highest annual take occurred in 2009 when 46 gray fox were reported harvested. As with other furbearing species, the reporting of gray fox take is voluntary and represents a minimum number of gray fox harvested. Since the reporting of harvest is not required, the actual number of gray fox harvest is currently unknown. Gray fox are also known to be taken to alleviate damage and threats of damage; however, the number of fox lethally taken annually to alleviate damage or threats of damage is currently unknown.

The WS program in Massachusetts has not previously been requested to address nest predation associated with gray fox through direct operational assistance. However, gray fox are known to occur in areas where ground nesting birds occur and given their omnivorous diet, the predation of eggs and nestlings could occur from gray fox. If predation occurs or is likely to occur due to a high fox density in an area where nesting occurs, WS could be requested to assist with reducing predation risks associated with gray fox. Based on previous requests received by WS to alleviate nest predation, WS could be requested to remove up to 50 gray fox to alleviate predation risks along with other damage management activities that could involve gray fox (USDA 2002). As part of other damage management activities, WS lethally removed one gray fox in FY 2009 and two gray fox in FY 2010. Using the lowest population estimate of 12,200 fox, the take of 50 gray fox by WS would represent 0.4% of the population. Given the stable population trend observed by the MDFW for gray fox in the Commonwealth, previous harvest levels and take to alleviate damage has not reached a level where a population decline has occurred. Like other mammal species addressed in this EA, the unlimited take allowed by the MDFW during the hunting and trapping seasons and the permitting of take to alleviate damage by the MDFW provides an indication that gray fox populations maintain sufficient densities within the Commonwealth to sustain unlimited harvest and that overharvest is unlikely.

Raccoon Population Information and Effects Analysis

The raccoon is a stocky mammal ranging from 61 to 91 cm (2-3 feet) long, weighing 4.5 to 13.5 kg (10 - 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 one of the most omnivorous of animals. It 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*b*). 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*b*). 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 - 2.9 miles) maximum, with some home range diameters of dense suburban populations to be 0.3 to 0.7 kilometers (0.2 - 0.4 miles).

Absolute raccoon population densities are difficult or impossible to determine because of the difficulty in knowing what percentage of the population has been counted or estimated 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 New Jersey in predominantly agricultural land on the inner coastal plain. 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 which ranged from nearly two raccoons to almost 650 raccoons per square mile in rural habitats with an average of 10 to 80 raccoons per square mile.

The statewide population of raccoons is currently unknown but the population is considered stable (L. Hajduk, MDFW pers. comm. 2011). Raccoons can be found throughout the Commonwealth and thrive in a variety of habitats including rural, suburban, and urban areas. Using the summarized density ranges for raccoons in rural areas provided by Riley et al. (1998) and the assumption that raccoons only inhabit 50% of the land areas of Massachusetts, a statewide population could be estimated to range from a low of nearly 7,900 raccoons to a high of over 2.5 million raccoons. Similar to estimates derived for the other mammal species in this EA, estimating that raccoons inhabit only 50% of the land area of the Commonwealth is intended to determine a minimum population estimate to compare the potential range of WS' proposed take of raccoons and to determine the magnitude of WS' proposed take.

WS provides assistance in addressing the spread of raccoon rabies in Massachusetts. Those activities are part of the national rabies barrier program covered under separate environmental analyses (USDA 2005). Other rabies monitoring or control activities may occur as part of this program. Raccoons lethally taken during activities to address the spread of raccoon rabies are covered by the EA and FONSI – Oral Vaccination to Control Specific Rabies Virus Variants in Raccoons, Gray Fox, and Coyotes in the United States (USDA 2005) but are included in this EA for cumulative impact analysis.

Raccoons are classified as furbearers in Massachusetts with a regulated annual hunting and trapping season with unlimited take allowed during the length of those seasons. During the annual hunting season for raccoons, up to three raccoons can be taken daily with no limit on the number that can be possessed during the length of the season. 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 Commonwealth. The number of raccoons reported as harvested, salvaged, or trapped in the Commonwealth from 2006 through 2009 are shown in Table 4-3. Reported take of raccoons during the hunting and trapping seasons is based on a voluntary trapper survey; therefore, take is considered as minimum take that likely occurred. Salvaged take includes raccoons that were recovered after being hit by automobiles. As with other furbearing species, raccoons can also be lethally taken to alleviate damage or threats of damage when authorized by the MDFW through the issuance of a permit. The total number of raccoons taken annually in the Commonwealth to alleviate damage or threats of damage is currently unknown and Table 4-3 does not include take reported by PAC agents.

Table 4-3: Cumulative raccoon take from known sources in Massachusetts, 2006-2010

Year	Harvest Take[1,2]	WS' Take[3,4]	Total
2006	125	7	**132**
2007	292	0	**292**
2008	239	5	**244**
2009	186	0	**186**
2010	N/A[†]	1	**N/A**
TOTAL	**842**	**13**	**854**

[1]Harvest take includes those raccoons reported on surveys as harvested during the hunting season and/or the trapping season and includes raccoon salvaged.

[2]Reported by season; for example, the 2006 entry covers the hunting and trapping season that began in 2006 and ended in 2007 since season often cover over from one calendar year to another with seasons general beginning in the fall and ending in late-winter

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

[4]WS' take includes raccoons lethally taken during activities conducted to prevent the spread of raccoon rabies in the Commonwealth

[†]N/A = Information is currently unavailable

WS' annual take of raccoons during all projects from 2006 to 2010 never exceeded 5.6% of the annual reported harvest for the corresponding year. The average number of raccoons reported harvested in the Commonwealth during the annual hunting and trapping seasons from 2006 through 2009 is 211 raccoons per year. Although harvest figures are not currently available for 2010, WS' take of one raccoon would represent less than 0.5% of the average annual harvest during the four previous harvest years. WS' previous take of raccoons to alleviate damage and as part of rabies monitoring has been of a low magnitude when compared to the number of raccoons reported harvested in the Commonwealth, especially given reported take is likely the minimum number of raccoons harvested.

Based on previous requests for assistance received by WS to alleviate nest predation and in anticipation of receiving additional requests for assistance with managing predation on ground nesting colonial waterbirds, up to 50 raccoons could be lethally removed by WS annually when requested. Using the lowest population estimate of 7,900 raccoons, the take of 50 raccoons would represent 0.6% of the population. Activities conducted to prevent the further spread of raccoon rabies in the Commonwealth 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 are visible injured or exhibit signs of disease, those raccoons are often euthanized. The number of raccoons lethally taken in the Commonwealth during the post-baiting trapping varies, but is not likely to exceed 50 individuals (USDA 2005).

Fisher Population Information and Effects Analysis

The fisher is one of the largest members of the the weasel family (Mustelidae). Fishers exhibit what is referred to as sexual dimorphism (physical differences) in body size between males and females. Adult male fishers weigh 3.6 to 7.3 kg (8 to 16 pounds) and measure approximately 90 cm (3 feet) from head to tail. Adult female fisher average 20% smaller than males, weighing 1.8 to 2.7 kg (4 to 6 pounds) and measure approximately 75 cm (2 ½ feet) in length. In both males and females, the tail accounts for approximately 1/3 of the total body length. The fisher exhibits the typical "*weasel*" shape with a long, slender body, short legs, and furred tail. They have a pointed face (although not as pronounced as fox or coyote) with large, rounded ears set close to the head. They are well adapted for climbing and have sharp, retractable claws similar to those of domestic cats. Their coloration is generally a rich brown to black with grizzled grayish coloring on the head and shoulders and the darkest coloring occurring on the rump, tail, and legs. Individuals may also have irregular white patches of fur on their chest and lower abdomen.

Although very secretive and rarely seen even in areas where they are abundant, the fisher is found throughout Massachusetts. Its range has expanded to areas in the southeast and most recently, Cape Cod. Fishers are not on the islands of Nantucket and Martha's Vineyard. Though it is not unusual to see this animal in suburbs, the fisher prefers wooded habitat. WS' personnel have observed fisher in piping plover nesting areas adjacent to scrub oak and pitch pine habitat in neighboring Rhode Island (E. Shaffer, WS, pers. comm. 2010).

They can be active day or night and tend to exhibit crepuscular and nocturnal activity in the summer and diurnal activity in the winter. They remain active year round and do not hibernate. Their preferred habitat is mixed forest with heavy canopy cover as they tend to avoid traveling in large open areas. They commonly use hollow logs, stonewalls, tree cavities, and brush piles as resting sites. Fishers are omnivorous. Their primary foods include small rodents, squirrels, rabbits, birds, eggs, fruit, porcupines, and carrion. They will also opportunistically prey on poultry and domestic cats. Although they are proficient climbers, most of their hunting takes place on the ground (MDFW 2009).

The statewide population of fishers is currently unknown, however, trapping data, visual sitings, and road kills indicate that the population is increasing and expanding across mainland Massachusett (L. Hajduk, MDFW, pers. comm. 2011). Like other mammal species addressed in this EA, fisher can be harvested in the Commonwealth during annual trapping seasons which allow an unlimited number of fisher to be lethally taken during the length of the season. Between 2006 and 2009, a total of 1,707 fishers were reported as harvested during the annual trapping season. The highest level of reported take occurred in 2007 when 582 fishers were harvested with the lowest reported take occurring in 2009 when 262 fishers were reported harvested. The average number of fishers lethally taken during the trapping season in the Commonwealth between 2006 and 2009 has been 427 fishers.

WS has not received requests for assistance associated with fisher in the Commonwealth; however, since fisher are known to occur in areas where nesting could occur and fisher are known to predate on a wide variety of food sources, WS could be requested to address nest predation or threats of nest predation when requested. Based on previous requests for assistance, WS could be requested to lethally take up to 50 fishers annually in the Commonwealth to alleviate nest predation. Take would only occur when permitted by the MDFW and only at levels permitted. WS' lethal take of 50 fishers would represent less than 11.7% of the average Massachusetts fisher harvest from the 2006 to 2009 trapping seasons.

Short-tailed Weasel Population Information and Effects 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 (7.5-11.8 in) in length with a tail measuring 4 to 8 cm (1.6-3.2 in) (Godin 1977). Males are approximately 25% larger than females and weights range between 45 and 105 g (1.6-3.7 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 Bristh Columbia to California (Palmer 1954). Short-tailed weasels possess musk glands similar to others in the Family Mustelidae, 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 exist that estimate population 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 21/mi^2 (8.1km^2) (Henderson 1994). In Ontario, Simms (1979) identified short-tailed weasel density from 6-10/100 ha (15.5-25.9/mi^2) depending on habitat type (King 1989). The short-tailed weasel is found in nearly all possible land habitats (Burt and Grossenheider 1976).

Population estimates for short-tailed weasels in Massachusetts are currently not available. Short-tailed weasels can be found in a variety of habitats across Massachusetts, and the population is thought to be stable (L. Hajduk, MDFW, pers. comm. 2011). To analyze impacts of WS' activities on short-tailed weasel populations in Massachusetts, the best available information will be used. If only 50% of the land area in Massachusetts is sufficient habitat to support short-tailed weasels, and using only 25% of the highest short-tailed weasel density reported by Henderson (1994) (21/mi^2), a conservative statewide short -tailed weasel population could be estimated at approximately 20,580 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 20,580 short-tailed weasels is likely low.

Short-tailed weasels are classified as a furbearer in Massachusetts with regulated trapping and no take limit (MDFW 2011). There are no tagging requirements for short-tailed weasels in Massachusetts, and therefore, no specific harvest information is available besides. When weasels are involved in property or agricultural damage, a landowner or their agent may lethally take weasels to alleviate that damage.

WS was not requested to lethally take short-tailed weasels from FY 2006 throug FY 2010. WS may be requested to address predation threats from short-tailed weasels, but lethal removal would not exceed 50 animals. Using the population estimate of 20,580 individuals, WS' lethal take of 50 short-tailed weasels for this project would impact less than 0.3% of the estimated population in Massachusetts. Therefore, WS' lethal removal of 50 short-tailed weasels is not likely to adversely impact short-tailed weasel populations in Massachusetts based on a stable populatioin. The permitting of the take by the MDFW ensures WS' take occurs within allowable harvest levels.

Long-tailed Weasel Population Information and Effects Analysis

The long-tailed weasel is a member of the weasel family (Mustelidae) and ranges in length from 30 to 40 cm (11.8-17.3 in) in length with a tail measuring 8 to 16 cm (3.2-6.3 in) (Godin 1977). Males are approximately 25% larger than females and weights range between 72 and 267 g (2.5-9.3 oz). 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 the northern latitudes of its range (Palmer 1954). Long-tailed weasels possess musk glands similar to others in Mustelidae, and will emit a strong and odiferous scent when frightened.

Long-tailed weasels range throughout most of the United States, except portions of the desert southwest, and in North America from southwest Canada to Peru (Godin 1977). These animals utilize a variety of habitats and prefer open woodlands, brushlands, or rocky areas near wetlands. 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. Gestation averages 279 days, and the young are typically born in April or May.

Few studies exist that estimate population and density for long-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 long-tailed weasels may exist in densities as high as 16 to 18/mi^2 (6.2-6.9 km^2) (Henderson 1994). In Pennsylvania scrub oak/pitch pine forest, Glover (1943) documented long-tailed weasels occurring in a density of 12/100 ha (31.1/ mi^2), and in Michigan farmland, Allen (1938) documented a density of only 3/100 ha (7.8/mi^2) (King 1989). The long-tailed weasel is found in all possible land habitats (Burt and Grossenheider 1976).

Population estimates for long-tailed weasels in Massachusetts are currently not available. Long-tailed weasels can be found in a variety of habitats across Massachusetts, and the population is thought to be stable (L. Hajduk, MDFW, pers. comm. 2011). To analyze impacts of WS' activities on long-tailed weasel populations in Massachusetts, the best available information will be used. If only 50% of the land area in Massachusetts is sufficient habitat to support long-tailed weasels, and using only 25% of the highest long-tailed weasel density reported by Henderson (1994) (18/mi^2), a conservative statewide long-tailed weasel population could be estimated at approximately 17,640 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 17,640 long-tailed weasels is likely low.

Long-tailed weasels are classified as a furbearer in Massachusetts with regulated trapping seasons and no take limit (MDFW 2011). Like short-tailed weasels, there are no tagging requirements for long-tailed weasels in Massachusetts, and therefore, exact harvest information is not available. When weasels are involved in property or agricultural damage, a landowner or their agent may kill or have killed those weasels responsible for causing damage.

Between FY 2006 and FY 2010, WS has not been requested to provide direct operational assistance associated with long-tailed weasels in the Commonwealth. WS may be requested to address predation threats from long-tailed weasels, but lethal removal would not exceed 50 animals. Using the population estimate of 17,640 individuals, WS' lethal take of 50 long-tailed weasels for this project would impact slightly more than 0.3% of the population in Massachusetts. Therefore, WS' lethal removal of 50 long-tailed weasels is not likely to adversely impact long-tailed weasel populations in Massachusetts.

Mink Population Information and Effects Analysis

The mink is also a member of the weasel family, ranging in size from 46 to 61cm (18-24 inches), including the somewhat bushy tail. These animals weigh between 0.7 and 1.4 kg (1.5-3 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*b*).

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 year-round except for brief intervals during periods of low temperature or heavy snow (Boggess 1994*b*). They may, however, adjust hunting times to prey availability (National Audubon Society 2000*b*).

Population densities for mink vary spatially according to habitat and may be influenced temporally by weather, trapping, and intraspecific aggression. Generally, populations are most dense in those states and provinces with abundant, stable aquatic habitat. In general, population densities typically range from

0.025 to 0.247 mink per acre (McVey et al. 1993). According to harvest statistics, Louisiana populations are most dense in swamps, followed by marshes and drained bottomlands (Linscombe et al. 1982). In Montana, Mitchell (1961) estimated that 280 mink inhabited a 33-km ^{2} (12.8 miles ^{2}) area, resulting in a density of 1 mink/11.8 ha (29.2 acres). However, the following year he estimated that there were only 109 mink in the area, a density of 1 mink/30.3 ha (74.7 acres). Fur harvest returns of 115 and 40 mink during the two years were comparable with returns from drained bottomland habitat in Louisiana. Marshall (1936) estimated densities from mink tracks in snow in Michigan. He reported 0.6 females in 1 km^2 (1.5/mi^2) of riverbank and a 1:1 sex ratio following heavy trapping. Errington (1943) counted 1 to 5 mink families occupying a 180-ha (450 acres) marsh in Iowa from 1933 to 1938. In 1939, no families were located. He felt that over-trapping was responsible for the low numbers, which continued after 1938. Errington also suggested that intraspecific aggression was responsible for the upper limit of mink inhabiting the marsh. McCabe (1949) estimated that there were 24 mink on a 445-ha (1,100 acres) refuge in Wisconsin during 1944, a density of 1 mink/18.8 ha (46.3 acres). He estimated that during the next four years (1945–48) the population ranged from 7 to 10. His estimates were inversely related to duration and depth of snow cover but were poorly related to food supply (rabbits [*Sylvilagus* spp.] and mice [*Peromyscus* spp.]). McCabe (1949) suggested that excessive poaching and heavy trapping on the borders of the refuge caused the low mink numbers following 1944. Gerell (1971) worked in two study areas in Sweden. In a 10,000 ha (25,000 acres) area he estimated that there were 11 and16 summer residents during two years, 1 mink/909 ha (2,245 acres) and 1 mink/625 ha (1,545 acres), respectively. In Gerell's (1971) other area, which included 10 km (6 miles) of riverbank, he estimated 3 and 6 summer residents in two years. In interior British Columbia, Ritcey and Edwards (1956) caught 11, 6, and 5 mink on 1.9 km (1.2 miles) of stream during three years. Densities from Ritcey and Edwards were similar to the estimate of 1.5 to 3.0 mink/km (2.5–5.0 mink/mile) of shoreline reported by Hatler (1976) for a coastal area of Vancouver Island. Mitchell (1961) reported that a turnover of the population occurred during a 3-year period, and Gerell (1971) concurred (Novak et al. 1987).

Mink are considered common throughout Massachusetts in areas with aquatic habitats. Mink are classified as furbearers in Massachusetts, with a regulated trapping season with unlimited take allowed during the length of the season (MDFW 2011). When mink are involved in property or agricultural damage, a landowner or their agent may lethally take those mink to alleviate that damage. The annual statewide fur harvest of mink in Massachusetts has ranged between 30 and 49 individuals with a total of 149 mink reported harvested from the 2006 to 2009 trapping seasons (L. Hajduk, pers. Comm. 2011). The number of mink lethally taken in the Commonwealth to alleviate damage or threats of damage is unknown.

WS has not received requests previously to address damage associated with mink in the Commonwealth. However, mink are known to occur in areas where grounding nesting occurs and mink are likely to predate eggs and nestlings of ground nesting birds given the food habits of mink. Based on requests received by WS previously, WS could be requested to lethally take up to 15 mink in the Commonwealth to alleviate nest predation or threats of predation. Although the statewide population of mink is unknown, the unlimited take allowed by the MDFW provides an indication that the species in not in likely to decline from overharvest.

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 non-aggressive and will 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 from 7 to 10 weeks. Litters commonly consist of 5 to 9 young with two litters per year possible (Hall and Kelson 1959). The home range of striped skunks is usually not consistent. Home ranges appear to be in relation to life history requirements such as winter denning, feeding activities, dispersal, and parturition (Rosatte 1987). 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 Massachusetts are currently not available. Striped skunks can be found in a variety of habitats across the Commonwealth except for the Elizabeth Islands and Nantucket. Populations of striped skunks are thought to be stable (L. Hajduk, MDFW pers. comm. 2011). If skunks only inhabit 50% of the land area of the Commonwealth and densities occur at one skunk per 77 acres, the statewide population could be estimated at nearly 32,500 skunks based on the land area in the Commonwealth estimated at 7,838 square miles. Similarly to other furbearing species, skunks can be found throughout the Commonwealth and the estimate is intended to evaluate the magnitude of take proposed under the proposed action.

Skunks can be lethally taken in the Commonwealth throughout the year with no limit on the number that can be taken. In addition, skunks can be trapped during an annual season which places no limit on the number of skunks that can be harvested daily and no limit on the number of skunks that can be possessed throughout the trapping season. The reported number of skunks harvested during the annual trapping seasons and from salvage is shown in Table 4-4. Like most furbearing species, the reporting of take is voluntary. Skunks are also lethally taken to alleviate damage or threats of damage; however, the number of skunks lethally taken annually in the Commonwealth to alleviate damage or threats of damage is currently unknown and Table 4-4 does not include take reported by PAC agents.

Table 4-4: Known cumulative take of striped skunks in Massachusetts, 2006-2010

Year	Harvest Take[1,2]	WS' Take[3]	Total
2006	8	0	**8**
2007	22	7	**29**
2008	23	1	**24**
2009	16	4	**20**
2010	N/A[†]	10	**N/A**
TOTAL	**69**	**22**	**81**

[1]Harvest take includes those striped skunks reported on surveys as harvested during the hunting season and/or the trapping season and includes striped skunks salvaged.

[2]Reported by season; for example, the 2006 entry covers the hunting and trapping season that began in 2006 and ended in 2007 since season often cover over from one calendar year to another with seasons general beginning in the fall and ending in late-winter

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

[†]N/A = Information is currently unavailable

Based on previous requests for assistance received by WS to alleviate nest predation and in anticipation of receiving additional requests for assistance with managing predation on ground nesting colonial waterbirds, up to 50 skunks could be lethally removed by WS annually when requested including skunks that are lethally removed to alleviate threats occurring at airports (USDA 2002). Using the lowest population estimate of 32,500 skunks, the take of 50 skunks would represent 0.2% of the estimated

statewide population.

Bobcat Population Information and Effects Analysis

The bobcat, also called "wildcat," is a medium-sized member of the North American cat family, and may be mistaken for a large bob-tailed domestic cat by some people. This species is actually 2 to 3 times larger than most domestic cats and appears more muscular and fuller in body. Bobcats are capable of hunting and killing prey that range from the size of a mouse to that of a deer. Rabbits, tree squirrels, ground squirrels, woodrats, porcupines, pocket gophers, and ground hogs comprise most of their diet. Opossums, raccoon, grouse, wild turkey, and other ground nesting birds are also eaten. Occasionally, insects and reptiles can be part of a bobcat's diet. They also resort to scavenging. They are opportunistic predators, and may feed on livestock and domestic animals such as poultry, sheep, goats, house cats, small dogs, exotic birds and game animals, and rarely, calves (Virchow and Hogeland 1994). McCord and Cardoza (1982) reported the cottontail rabbit to be the principal prey of bobcats throughout their range. Although nest predation by bobcats in Massachusetts has not been documented, the presence of bobcats in areas where nesting occurs could lead to requests for assistance to alleviate predition threats given that bobcats are opportunistic predators that would like feed on eggs or nestlings of ground nesting birds if located.

Bobcats reach densities of about 1 per 0.7 km^2 (1 per ¼ mi^2) on some islands in the Gulf Coast of the southeastern United States. Densities vary from about 1 per 1.3 km^2 (1 per ½ mi^2) in coastal plains to about 1 cat per 10.7 km^2 (1 per 4 mi^2) in portions of the Appalachian foothills. Mid-Atlantic and mid-western states usually have scarce populations of bobcats (Virchow and Hogeland 1994). Populations are stable in many northern states and increasing in other states where intensive trapping formerly decimated the species (National Audubon Society 2000*b*). Rates of natural mortality reported for adult bobcats in protected populations appear to be quite low. Crowe (1975) estimated a 3% mortality rate in a protected population, based on Bailey's (1972) study of bobcats in southeastern Idaho. Causes of natural mortality for adult bobcats include starvation (Hamilton 1982), disease and predation (Lembeck 1978), and injuries inflicted by prey (Fuller et al. 1985).

Bobcats are common in in central and western Massachusetts and are less common but can be found in suitable habitat in the northeastern portion of the Commonwealth. In the southeastern portion of the Commonwealth, bobcats are rare to absent with no known populations on Cape Cod, Nantucket, Martha's Vineyard, or the Elizabeth Islands. Population estimates for bobcats in Massachusetts are not readily available. Population trend estimates provided by the MDFW indicate a stable to increasing population in Massachusetts resulting in elimination of the harvest quota for 2011. Since population estimates are not available for bobcats, the best available data will be used to estimate a population size to analyze impacts.

Bobcats are classified as furbearers in Massachusetts, with a regulated hunting and trapping season with unlimited take (MDFW 2011). The number of bobcat pelts tagged by hunters and trappers in Massachusetts has averaged nearly 50 bobcats per year between the 2006 and 2009 hunting and trapping seasons (L. Hajduk, MDFW pers. comm. 2011). As mandated through the Convention on International Trade in Endangered Species, the MDFW requires that all bobcat pelts to be sold must be tagged. However, bobcats can be found statewide in Massachusetts with the exception of Nantucket and Martha's Vineyard islands, where suitable habitat occurs and are not considered an endangered species.

Habitat preferred by bobcats is quite diverse in Massachusetts ranging from upland forests to coastal wetlands. If only 50% of the land area of Massachusetts represents suitable bobcat habitat and using density estimates for the Appalachian foothills of 1 bobcat per 4 mi^2, a statewide population could be estimated to be approximately 980 bobcats. However, this estimate could be considered low given that where quality habitat and prey are available densities tend to be much higher. A recent study where

bobcats were reintroduced to an island off the coast of Georgia, bobcat densities stabilized at 1 bobcat per 1.2 mi^2 (Diefenbach et al. 2006). A total bobcat population could be estimated at 3,267 using a density of 1 bobcat per 1.2 mi^2. Under a worst case scenario, if only 25% of the land area in Massachusetts was suitable for bobcat populations, a population could be estimated at 1,633 bobcats using densities found by Diefenbach et al. (2006).

WS has not previously received requests for assistance to manage damage or threats of damage associated with bobcats. WS may be requested to address damage being caused by bobcats in coastal habitat in Massachusetts to protect nesting colonial waterbirds, shorebirds, and T&E species. Based upon an anticipated increase in bobcat damage management activities in the future, it is possible that WS could kill 25 bobcats per year during nest predator damage management programs in Massachusetts. Under the worst case scenario outlined above based on population densities of 1 bobcat per 4 mi^2, if 25 bobcats were removed, the take would represent less than 2.6% of the estimated bobcat population in Massachusetts of 980 bobcats. The statewide population is likely higher than 980 bobcats and the unlimited take allowed by the MDFW indicates the species is not likely to be overharvested. The take of bobcats by WS would only occur when permited by the MDFW and only at levels permitted.

Feral Cat Population Information and Effects 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 3 to 8 pounds (1.4 to 3.6 kg), standing 8 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 - 30.5 cm (8 - 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 2 to 10 kittens during any month of the year. An adult female may produce 3 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 3 to 5 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 to be totally wild in habits and temperament (Fitzwater 1994).

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 may 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 are estimated to kill at least one billion birds every year in the United States. Cats have contributed to declines and extinctions of birds worldwide and are 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).

WS has not previously received requests for assistance associated with feral cats. Under the proposed action alternative all cats that are live captured as part of the proposed program are either returned to the cat's owner if proper identification can be determined or taken to an animal shelter for health evaluation and if possible, adoption. The final disposition of the feral cats would be determined by the animal shelter.

The number of feral and free-ranging cats in Massachusetts is unknown. The lowest estimate of the United States feral cat population is 20 million (Cummings 2003). Because feral and free-ranging cats are considered to be a detriment to native wildlife species, removing cats could be considered to have beneficial effects on the environment by eliminating predation and competition from an exotic species. Based upon the above information, WS' capture and transfer of possession of feral and free ranging cats to animal shelters would not have negative effects on local or statewide populations of this species in Massachusetts. WS does not anticipate live-capturing more than 30 feral cats annually in the Commonwealth under the proposed action alternative.

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 Commonwealth and can be found throughout the year (Robbins and Blom 1996).

Historically, crow populations have benefited from agricultural development because of grains available as a food supply. Crows typically roost in trees with the combination of food and tree availability being favored. In some areas where abundant food and roosting sites are available, large flocks of crows tend to concentrate. In the fall and winter, crows often form large roosting flocks in urban areas. Those large flocks disperse to different feeding areas during the day. Crows can fly from 6 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.

The American crow population in Massachusetts has been estimated at 110,000 crows statewide based on BBS data (Rich et al. 2004). From 1966 through 2007, trend data from the BBS indicates the number of crows observed in the Commonwealth during the survey has increased at an annual rate of 1.2% (Sauer et al. 2008). The number of crows observed in the Commonwealth in areas surveyed during the CBC has shown a general increasing trend since 1966 (NAS 2010).

As discussed previously, blackbirds, including crows, can be taken without a depredation permit issued by the USFWS when committing or about to commit damage or posing a threat to human safety under a blackbird depredation order. In addition, crows can be harvested in the Commonwealth during a regulated season that allows an unlimited number of crows to be harvested. However, the number of crows lethally removed to alleviate damage or threats of damage annually in the Commonwealth is currently unknown. Similarly, the number of crows harvested in the Commonwealth during the annual hunting season is also unknown.

From FY 2006 through FY 2010, WS has addressed 64,394 crows in the Commonwealth to manage damage or reduce threats. Of those 64,394 crows addressed by WS, 705 crows were lethally taken to alleviate damage or threats while 63,689 crows were addressed using non-lethal methods. The highest level of crow take by WS occurred in FY 2010 when 302 crows were addressed using lethal methods in the Commonwealth while 19,762 crows were dispersed using non-lethal methods. The highest level of

non-lethal dispersal occurred in FY 2009 when 34,384 crows were dispersed, while 235 were addressed using lethal methods. Based on previous requests for assistance and in anticipation of an increase in the need to address an increasing number of requests for crow damage management, up to 200 American crows could be lethally taken annually by WS to alleviate nest predation in the Commonwealth. In addition, WS could take up to 500 American crows to alleviate strike risks occurring at airports in the Commonwealth (USDA 2002).

The use of population trends as an index of magnitude is based on the assumption that annual harvests do not exceed allowable harvest levels. State wildlife management agencies act to avoid over-harvests by restricting take (either through hunting season regulation and/or permitted take) to ensure that annual harvests are within allowable harvest levels. If crow populations have remained at least stable in the Commonwealth, WS' annual take of up to 200 American crows would represent 0.2% of the estimated statewide crow population. If 200 crows were lethally taken by WS to alleviate nest predation and if 500 crows were lethally taken by WS to alleviate strikes risks at airports in the Commonwealth, the combined take would represent 0.6% of the estimated statewide population of crows. The take of crows under the depredation order by other entities is likely to be a small contributor to the cumulative take of crows annually. Although some take is likely to occur, take is not expected to reach a high magnitude. Similarly, the take of crows during the annual hunting season is likely of low magnitude when compared to the statewide population. Given that the number of American crows observed during statewide surveys are showing increasing trends (NAS 2010, Sauer et al. 2008), the population of crows have not declined since those population estimated were calculated and have likely remained at least stable despite the take of crows by WS and other entities under the depredation order and during the annual hunting season.

Fish Crow Population Impact Analysis

Fish crows are considered a local permanent resident in Massachusetts that are most often found along the coast, large river drainages and lakes of the Commonwealth. The fish crow is an uncommon and local bird in Massachusetts, where it is near the northernmost part of its range. Fish crows have been found nesting in several locations in the Boston metropolitan area, in southern Essex County, and in Plymouth County. Throughout most of its range, this species favors coastal and brackish habitats, including wooded shorelines, marshes, beaches, and the vicinity of tidal rivers (Stymeist 2003). Difficulty in identifying this species probably has led to an underestimate of its range, both current and historic. Although the fish crow is slimmer and has a narrower beak and smaller legs, it is difficult to distinguish from the American crow (Fussell 1994).

Crows often form mixed species roosts which can contain both American crows and fish crows. Fish crows are often confused with American crows with the only reliable distinction between the two species being vocal (Mcgowan 2001). Given the similar physical appearance of the two species, estimating the number of individual fish crows or American crows in a roost or flock of crows based on visual cues can be difficult. Isolating and distinguishing the vocalizations of an individual crow for species identification in a mixed species flock of crows can also be difficult.

Fish crows are not as abundant as American crows and are not as widely distributed across the Commonwealth. American crows can be found throughout the Commonwealth while fish crows are most commonly found along the major rivers coastal areas. From 1996 through 2007, the BBS estimates the relative abundance of American crows in the Commonwealth at 29.87 crows observed per BBS route compared with 0.15 fish crows observed per BBS route (Sauer et al. 2008). Although fish crows and American crows form mixed species flocks, most flocks of crows or crow roosts encountered is the Commonwealth consists primarily of American crows. Based on previous requests for assistance and in anticipation of requests address nest predation up to 50 fish crows could be taken by WS under the proposed action. Although not as abundant in the Commonwealth, fish crows could be present in areas

where nesting occurs. The number of fish crows observed during the BBS has shown an increase in the Commonwealth since 1966 estimated at 9.8% annually (Sauer et al. 2008). The number of fish crows observed annually during the CBC has been highly variable since 1966 (NAS 2010) which is likely related to the severity of the corresponding winter in the Commonwealth. Rich et al. (2004) estimated the statewide population of fish crows at 300 birds based on BBS data.

The data quality rating assigned by Rich et al (2004) for the population estimate for fish crows in the Commonwealth indicates that the population estimates for fish crows is poor in Massachusetts due to high variance on BBS counts, low sample size, and/or due to other species-specific limitations of BBS survey methods. Population estimates calculated by Rich et al. (2004) were derived from BBS data for individual species using detectability factors developed for each species. As stated previously, fish crows are difficult to distinguish from American crows. The limitations associated with distinguishing crow species and the survey protocols under current BBS guidelines is the likely cause of the poor data quality ratings assigned by Rich et al. (2004) for the populations estimates of fish crows in Massachussetts. Given the limitations of current survey protocols, populations of fish crows in the Commonwealth are likely much higher than currently derived from survey data.

During FY 2006 through FY 2010, WS did not use lethal methods to reduce damage caused by fish crows. WS does not anticipate killing more than 50 fish crows per year. Given the general increasing trend of fish crows and that WS' crow damage management activities would only be conducted at a limited number of sites involving a very small portion of the area in the Commonwealth; the proposed action would not adversely impact the Commonwealth, regional or national fish crow population.

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

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

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 contains the active ingredient methiocarb and is registered by the EPA for use to condition crows not to feed on the eggs of T&E avian species. Mesurol is currently not registered for use in Massachusetts but will be evaluated in this assessment as a repellent that could be employed under the proposed action or this alternative if the product becomes available. Mesurol is mixed with water and once mixed, placed inside raw eggs that are similar in size and appearance to the eggs of the species being protected. Treated eggs are placed in the area where the protected species are known to nest at least three weeks prior to the onset of egg-laying to condition crows to avoid feeding on eggs. Methicarb is a carbamate pesticide that acts as a cholinesterase inhibitor. Crows ingesting treated eggs become sick (*e.g.*, regurgitate, become lethargic) but recover. Since crows ingesting mesurol only become sick and generally recover, no impacts 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.

Issue 2 - Effects of Damage Management 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 damage caused by nest predators. The potential effects on the populations of non-target wildlife species under each of the alternatives are analyzed below.

Alternative 1 – No Nest Predator Damage Management Conducted by WS

Under this alternative, WS would not be directly involved with nest predator damage management activities in the Commonwealth. 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 persons who implement nest predator damage management activities on their own or through recommendations by the other federal, Commonwealth, and private entities. Although some risks occur from those persons that implement nest predator damage management in the absence of any involvement by WS, those risks are likely low and are similar to those under the other alternatives.

The ability to reduce negative impacts caused by nest predators to other wildlife species and their habitats would be variable based upon the skills and abilities of the person implementing damage management actions under this alternative.

Alternative 2 – Nest Predator Damage Management 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 are employed, as recommended by WS, the potential impacts to non-targets are likely similar to the proposed action. If recommended methods and techniques are not followed or if other methods are employed that were not recommended, the potential impacts on non-target species is likely higher compared to the proposed action.

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

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

If requestors are provided technical assistance but take no actions, the potential impacts to non-targets

would be lower compared to the proposed action. If those persons requesting assistance implement recommended methods appropriately and as instructed or demonstrated, the potential impacts to non-targets would be similar to the proposed action. Methods or techniques not implemented as recommended or used inappropriately would likely increase potential impacts to non-targets. Therefore, the potential impacts to non-targets would be variable under a technical assistance only alternative.

The ability to reduce negative impacts caused by nest predators would be variable based upon the skills and abilities of the person implementing damage management actions. It would be expected that this alternative would have a greater chance of reducing nest predation than Alternative 1 since WS would be available to provide information and advice.

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

The potential adverse affects 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 use of non-lethal methods as part of an integrated direct operational assistance program would be similar to those risks to non-targets discussed in the other alternatives.

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

Non-lethal methods have the potential to cause adverse affects to non-targets primarily through exclusion, harassment, and dispersal. Any exclusionary device erected to prevent access of target species also potentially excludes species that are not the primary reason the exclusion was erected; therefore, non-target species excluded from areas may potentially be adversely impacted if the area excluded is large enough. The use of auditory and visual dispersal methods used to reduce damage or threats caused by nest predators are also likely to disperse non-targets in the immediate area the methods are employed. Therefore, non-targets may be permanently dispersed from an area while employing non-lethal dispersal techniques. However, like target species, the potential impacts on non-target species are expected to be temporary with target and non-target species often returning after the cessation of dispersal methods.

Other non-lethal methods available for use under this alternative include cage traps, foothold traps, and repellents. Cage traps and foothold traps restrain wildlife once captured and are considered live-capture methods. Cage traps and foothold traps have the potential to capture non-target species. Trap placement in areas where target species are active and the use of target-specific attractants would likely minimize the capture of non-targets. If traps are attended to appropriately, any non-targets captured can 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 is mesurol for use to discourage crows from feeding on the eggs of T&E species. Mesurol is not currently registered for use in Massachusetts. The use and recommendation of repellents would not have negative impacts on non-target species when used according to label requirements. Mesurol is prepared and inserted into eggs that

are 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.

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

WS would also employ and/or recommend lethal methods under the proposed action alternative to alleviate damage. Lethal methods available for use to manage predation under this alternative would include shooting, trapping, the avicide DRC-1339, and the recommendation that nest predators be harvested during a regulated harvest season in the Commonwealth. 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 nest predators damage is further discussed in Appendix B.

The use of firearms is essentially selective for target species since animals are identified prior to application; therefore, no adverse impacts are anticipated from use of this method.

A significant issue when dealing with nest predators is the effectiveness of box/cage traps, particularly to capture coyotes. Several methods of trapping discussed in Appendix B are restricted or banned by Massachusetts law. This includes, but is not limited to, the use of conibear traps, foot-hold traps, and cable restraints. However, MDFW has acknowledged that the Commonwealth does not have the authority to restrict WS' use of banned traps on federal property (W. MacCallum, MDFW pers. comm. 2010). WS would not employ or recommend those methods for use in the Commonwealth with the exception of federal property.

A common concern regarding with the use of DRC-1339 is the potential non-target risks. All label requirements of DRC-1339 would be followed to minimize non-target hazards. As required by the label, all potential bait sites are pre-baited and monitored for non-target use as outlined in the pre-treatment observations section of the label. If non-targets are observed feeding on the untreated pre-bait, the plots are abandoned and no baiting would occur at those locations. Treated bait is mixed with untreated bait per label requirements when applied to bait sites to minimize the likelihood of non-targets finding and consuming bait that has been treated. The bait type selected can also 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 are monitored daily to further observe for non-target feeding activity. If wildlife are observed feeding on bait, those sites are abandoned. By acclimating target bird species to a feeding schedule, baiting can occur at specific times to ensure bait placed is quickly consumed by target bird species, especially when large flocks of target species are present. The acclimation period allows for treated bait to be present only when birds are conditioned to be present at the site and provides a higher likelihood that treated bait is consumed by the target species which makes it unavailable to non-targets. In addition, with many blackbird species, including crows, when present in large numbers, tend to exclude non-targets from a feeding area due to their aggressive behavior and by the large number of conspecifics present at the location. Therefore, risks to non-target species from consuming treated bait

only occurs when treated bait is present at a bait location. WS would retrieve all dead crows to the extent possible following treatment with DRC-1339 to minimize secondary hazards associated with scavengers feeding on crow carcasses.

DRC-1339 Primary Hazard Profile - DRC-1339 was selected for reducing crow damage because of its high toxicity to blackbirds (DeCino et al. 1966, West et al. 1967, Schafer 1972) and low toxicity to most mammals, sparrows, and finches (Schafer and Cunningham 1966, Apostolou 1969, Schafer 1972, Schafer 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})[4] values for starlings, blackbirds, and magpies (Corvidae) range from one to five mg/kg (Eisemann et al. 2003). For American crows, the median acute lethal dose has been estimated at 1.33 mg/kg (DeCino et al. 1966). The acute oral toxicity (LD_{50}) of DRC-1339 has been estimated for over 55 species of birds (Eisemann et al. 2003). DRC-1339 is toxic to mourning doves (*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 of poison (DeCino et al. 1966). Avian reproduction does not appear to be affected from ingestion of DRC-1339 treated baits until levels are ingested where toxicity is expressed (USDA 2001).

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

Based on those concerns, the Ecological Committee on FIFRA Risk Assessment (ECOFRAM) was established by 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).

[4]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.

DRC-1339 Secondary Hazards -Secondary poisoning has not been observed with DRC-1339 treated baits. During research studies, carcasses of birds which died from DRC-1339 were fed to raptors and scavenger mammals for 30 to 200 days with no symptoms of secondary poisoning observed (Cunningham et al. 1979). This can be attributed to relatively low toxicity to species that might scavenge on blackbirds killed by DRC-1339 and its tendency to be almost completely metabolized in the target birds which leaves little residue to be ingested by scavengers. Secondary hazards of DRC-1339 are almost non-existent.

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

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 nontarget animals and found no nontarget carcasses that exhibited histological signs consistent with DRC-1339 poisoning. The other studies also failed to detect any nontarget birds that had succumbed to DRC-1339. However, DRC-1339 is a slow-acting avicide and thus, some birds could move to areas not searched by the study participants before dying.

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

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

Several 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 1 treated bait for every 25 untreated baits, the likelihood of a crow selecting treated bait and then caching the bait is further reduced.

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

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 affects to non-targets primarily through exclusion, harassment, and dispersal. Any exclusionary device erected to prevent access of target species also potentially excludes species that are not the primary reason the exclusion was erected, therefore; non-target species excluded from areas may potentially be adversely impacted if the area excluded is large enough. The use of auditory and visual dispersal methods used to reduce predation caused by target species are also likely to disperse non-targets in the immediate area the methods are employed. Therefore, non-targets may be permanently dispersed from an area while employing non-lethal dispersal techniques. However, like target species, the potential impacts on non-target species are expected to be temporary with target and non-target species often returning after the cessation of dispersal methods.

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 are active and the use of target-specific attractants possibly will minimize the capture of non-targets. If traps are attended to appropriately, any non-targets captured can 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 and euthanasia drugs would not be available for use by the general public under this alternative and would not be recommended through technical assistance. Immobilizing and euthanasia drugs would only be available for direct operational use by WS' personnel. Immobilizing drugs are applied either after live-capture occurs through injection or are applied through direct application to target individuals from a dart gun, blow gun, or jabstick. Therefore, immobilizing drugs are only applied after identification of the target occurs prior to application. No direct affects to non-targets would occur from the use of immobilizing drugs. Nest predators immobilized and then euthanized using euthanasia drugs would be disposed of by deep burial or by incineration which would make the carcasses unavailable to non-targets.

Nest predators could still be lethally taken during the regulated harvest season and as permitted by the MDFW under this alternative. Impacts to non-targets from the use of non-lethal methods would be similar to the use of non-lethal methods under any of the alternatives. Non-targets would generally be unharmed from the use of non-lethal methods under any of the alternatives since no lethal take would occur. Non-lethal methods would be available under all the alternatives analyzed. WS' involvement in the use of or recommendation of non-lethal methods would ensure non-target impacts are considered under WS' Decision Model. Impacts to non-targets under this alternative are likely to be low.

Issue 3 – Effects of Damage Management Activities on Threatened and Endangered Species

The potential effects on the populations of T&E species under each of the alternatives are analyzed below.

Alternative 1 – No Nest Predator Damage Management Conducted by WS

Under this alternative, WS would not be directly involved with nest predator damage management activities in the Commonwealth. Therefore, no direct impacts to T&E species, either positive or negative, would occur by WS under this alternative. Nest predators could continue to be taken through the issuance of depredation permits by the USFWS and the MDFW. Risks to T&E species would continue to occur from nest predators. Also, threats would be caused by those persons who implement nest predator damage management activities on their own or through recommendations by the other federal, Commonwealth, and private entities that do not possess the training and experience in managing nest predators. Although some risks occur from implementing nest predator damage management in the absence of any involvement by WS, those risks are likely lower than allowing unmanaged predation and are similar to those under the other alternatives.

The ability to reduce negative impacts caused by nest predators to nesting colonial birds and T&E species would be variable based upon the skills and abilities of the person implementing damage management actions under this alternative.

Alternative 2 – Nest Predator Damage Management 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 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 negative impacts to T&E species 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 T&E species under this alternative would be variable and based on several factors. If methods are employed, as recommended by WS and cooperating agencies, the potential impacts to T&E species are likely similar to the proposed action. If recommended methods and techniques are not followed or if other methods are employed that were not recommended, the potential negative impacts on T&E species is likely higher compared to the proposed action.

The potential impacts of harassment and exclusion methods to T&E species would be similar to those described under the proposed action. Harassment and exclusion methods are easily obtainable and simple to employ. Since identification of targets occurs when employing shooting as a method, the potential impacts to T&E species are likely low under this alternative.

Those persons concerned about nest predation may implement methods and techniques based on the recommendations of WS. The potential for impacts would be based on the knowledge and skill of those persons implementing recommended methods. Potential impacts from providing only technical assistance could be greater than those described in the proposed action if those persons concerned with nest predation do not implement methods or techniques correctly. Incorrectly implemented methods or techniques recommended by WS could lead to unintentional take of T&E species or failure to manage nest predators leading to continued depredation of eggs, chicks, fledglings and even adults.

If requestors are provided technical assistance but do not implement any of the recommended actions, the potential negative impacts to T&E species would be higher compared to the proposed action. If those requesting assistance implement recommended methods appropriately and as instructed or demonstrated, the potential impacts to non-targets would be similar to the proposed action. Methods or techniques not implemented as recommended or used inappropriately would likely increase potential negative and reduce potential beneficial 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 negative impacts caused by nest predators to T&E species would be variable based upon the skills and abilities of the person implementing damage management actions. It would be expected that this alternative would have a greater chance of reducing damage than Alternative 1 since WS would be available to provide information and advice.

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

Under the proposed action, WS could provide both technical assistance and direct operational assistance to those persons requesting assistance. The use of non-lethal methods as part of an integrated direct operational assistance program would be similar to those risks to T&E species discussed in the other alternatives. Personnel from WS are experienced and trained in wildlife identification and to select the most appropriate methods for taking targeted animals and excluding non-target species. To reduce the likelihood of capturing non-target wildlife and negatively impacting T&E species, 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 and T&E species. SOPs to prevent and reduce any potential adverse impacts on non-targets are discussed in Chapter 3 of this EA. Despite the best efforts to minimize non-target take during program activities, the potential for adverse impacts to non-targets, including T&E species exists when applying both non-lethal and lethal methods to manage damage or reduce threats to safety.

Non-lethal methods have the potential to cause adverse affects to non-targets primarily through exclusion, harassment and dispersal. Any exclusionary device erected to prevent access of target species also potentially excludes species that are not the primary reason the exclusion was erected; therefore, non-target species excluded from areas may potentially be adversely impacted if the area excluded is large enough. The use of auditory and visual dispersal methods used to reduce damage or threats caused by nest predators are also likely to disperse non-targets, including T&E species, in the immediate area the methods are employed. Therefore, non-targets, including T&E species, may be permanently dispersed from an area while employing non-lethal dispersal techniques. However, like target species, the potential impacts on non-target species from the use of non-lethal methods are expected to be temporary with target and non-target species often returning after the cessation of dispersal methods.

Other non-lethal methods available for use under this alternative include live-traps and repellents. Live traps (*e.g.*, cage traps) restrain wildlife once captured and are considered live-capture methods. Live traps have the potential to live-capture non-target species. Trap placement in areas where target species are active and the use of attractants as specific to the target species as possible would minimize the likelihood of capturing non-targets, including T&E species. Though the use of live-traps are virtually selective for target individuals and live-capture does occur from those methods, the potential for death of a target or non-target animal while being restrained or released does exists. Trap placement in areas where target species are active and the use of target-specific attractants would likely minimize the capture of non-targets. If traps are attended to appropriately, any non-targets captured can be released on site unharmed. The lethal take of non-targets from using those methods is unlikely with take never reaching a magnitude that a negative impact on populations would occur. Any potential non-targets captured using non-lethal methods would be handled in such a manner as to ensure the survivability of the animal if released. The potential adverse affects associated with non-lethal methods are negligible and, in the case of exclusion and harassment methods, often temporary.

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

Only those repellents registered with the EPA pursuant to the FIFRA and registered for use in the Commonwealth would be recommended and used by WS under this alternative. Therefore, the use and recommendation of repellents would not have negative impacts on non-target species, including T&E species, when used according to label requirements. Most repellents for nest predators are delivered from through ingestion of treated bait and pose a low risk to non-targets, including T&E species.

Overall, impacts to T&E species from the use of non-lethal methods would be similar to the use of non-lethal methods under any of the alternatives. T&E species would generally be unharmed from the use of non-lethal methods under any of the alternatives since no lethal take would occur with the intent of a beneficial impact due to the dispersal of nest predators resulting in reduced predation. Non-lethal methods would be available under all the alternatives analyzed. WS' involvement in the use of or recommendation of non-lethal methods would ensure T&E species impacts are considered under WS' Decision Model. Beneficial impacts to T&E species under this alternative from the use of and/or the recommendation of non-lethal methods are likely to be high and negative impacts are likely to be low.

WS would also employ and/or recommend lethal methods under the proposed action alternative to alleviate damage. Lethal methods available for use to manage damage caused by nest predators under this alternative would include shooting, use traps and legal harvest through hunting and trapping. In

addition, nest predators could also be euthanized once live-captured by other methods. Lethal take of live-captured nest predators would occur pursuant to WS Directive 2.505. Available methods and the application of those methods to resolve large rodent damage are further discussed in Appendix B.

Immobilizing and euthanasia drugs are applied directly to the target individual through injection only after that individual is properly restrained and immobilized. Therefore, immobilizing and euthanizing drugs would have no direct adverse impact on non-targets. Carcasses of nest predators euthanized with euthanasia drugs would be disposed of by deep burial or by incineration to prevent consumption of the carcasses by non-targets. The use of firearms is essentially selective for target species since animals are identified prior to application; therefore, no adverse impacts are anticipated from use of this method.

Based on a thorough Risk Assessment, APHIS has concluded that, when the WS' program uses chemical methods, including those referenced above, in accordance with label directions, they are highly selective to target individuals or populations, and such use has negligible effects on the environment (USDA 1997).

Special efforts are made to avoid jeopardizing T&E species through biological evaluations of the potential effects and the establishment of special restrictions or mitigation measures. SOPs to avoid T&E effects are described in Chapter 3 of this EA and in WS' programmatic FEIS (USDA 1997).

Federally Listed Species - The list of species designated as threatened and endangered in the Commonwealth of Massachusetts as determined by the USFWS and the National Marine Fisheries Service was obtained and reviewed during the development of this EA (see Appendix C). Consultation with the USFWS under Section 7 of the ESA concerning potential impacts of WS' programmatic activities on T&E species was conducted as part of the development of WS' programmatic FEIS. WS obtained a BO from the USFWS addressing WS' programmatic activities. For the full context of the BO, see Appendix F of WS' programmatic FEIS (USDA 1997). During the development of this EA, consultation with the USFWS under Section 7 of the ESA also occurred. Based on consultation with the USFWS, the USFWS acknowledges the proposed activities would benefit those ground nesting T&E species along the mainland and island costal beaches of Massachusetts. In addition, WS would consult with the USFWS on a site-by-site basis in order to conclude with a determination of effects (T. Chapman, USFWS pers comm. 2011).

Commonwealth Listed Species - The list of T&E species designated by the Commonwealth was also obtained during the development of this EA (see Appendix D). Based on the methods and scope of activities proposed under this alternative, activities conducted within the scope of analysis would benefit those ground nesting species listed as threatened, endangered, or species of special concern and have no effect on other species listed as threatened and endangered in the Commonwealth of Massachusetts.

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 affects to non-targets, including T&E species, primarily through exclusion, harassment, and dispersal.

Any exclusionary device erected to prevent access of target species to nests also limits access by the nesting adults and exit sites of precocial chicks of the T&E species that it was erected to protect. This may result in breeding adults being funneled toward limited access points when coming and going from their nest to feed and drink. This makes them easy targets for avian predators such as hawks and owls that simply wait for the adults to attempt to enter or exit the exclosure. Loss of breeding adults is more

significant than the loss of eggs or chicks to T&E species.

Installation of exclusionary structures is also be used by some species such as American crows to actually locate nests to prey on eggs. Even if overhead cover is provided, crows have been documented waiting for precocial chicks of piping plovers to exit exclosures after hatching (M. Hake, NPS, Public Presentation 2010).

The use of auditory and visual dispersal methods used to reduce damage or threats caused by target species are also likely to disperse the very nesting colonial waterbirds and T&E species being protected in the immediate area the methods are employed. The potential impacts on adult nesting colonial waterbirds and T&E species are generally expected to be temporary. Dispersed wildlife usually returns after the cessation of dispersal methods. However, nesting colonial waterbirds and T&E species may be permanently dispersed from a colony or nest site. Eggs or chicks could be lost due to exposure to cold, heat or precipitation while adults are forced off of nests while non-lethal dispersal techniques are employed.

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 T&E species. Trap placement in areas where T&E species are active and the use of target-specific attractants possibly would minimize the risk of capturing T&E species. If traps are attended to appropriately, any T&E species captured can 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 T&E species discussed under the proposed action alternative.

Nest predators could still be lethally taken during the regulated harvest season and as permitted by the MDFW under this alternative. Impacts to T&E species from the use of non-lethal methods would be similar to the use of non-lethal methods under any of the alternatives. T&E species would generally be unharmed from the use of non-lethal methods under any of the alternatives since no lethal take would occur. Non-lethal methods would be available under all the alternatives analyzed. WS' involvement in the use of or recommendation of non-lethal methods would ensure T&E species impacts are considered under WS' Decision Model. Impacts to T&E species under this alternative are likely to be low.

Issue 4 - Effectiveness of Nest Predator Damage Management

A common issue when addressing wildlife damage is the effectiveness of the methods being employed to resolve the damage. Methods being employed to resolve nest predation must be effective at resolving damage or threats within a reasonable amount of time to prevent further economic loss. The issue of method effectiveness as related to each alternative analyzed in detail is discussed below.

Alternative 1 – No Nest Predator Damage Management Conducted by WS

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 which are restricted to use by WS only. WS would not be directly involved with application of any methods to resolve nest predation in the Commonwealth under this alternative. The recommendation of methods and the use of methods would be the responsibility of other entities. When available methods are employed as intended, a reasonable amount of effectiveness is expected. If methods are employed incorrectly due to a lack of knowledge or if methods are employed without consideration of the behavior of nest predators, those methods being employed are likely to 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, including the use of firearms and live-capture followed by euthanasia. Since WS would not be involved with any aspect of nest predator damage management 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 – Nest Predator Damage Management by WS through Technical Assistance Only

With WS providing technical assistance but no direct management under this alternative, entities requesting assistance would either take no action, which means conflicts and damage would likely continue or increase in each situation, or implement WS' recommendations for non-lethal and lethal methods. Methods of frightening or dispersing nest predators have been effective at specific sites. In most instances however, those methods simply shift the problem elsewhere (Conover 1984, Aguilera et al. 1991, Swift 1998). Habitat modifications, while potentially effective, are poorly accepted, not widely employed, and are not 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 is occurring. Population reduction would be limited to applicable Commonwealth and federal laws and regulations authorizing take of nest predators, including legal hunting and take pursuant to the depredation order. However, individuals or entities that implement management may not have the experience necessary to efficiently and effectively conduct the actions.

Under an alternative in which WS would only provide technical assistance to those persons requesting assistance, those methods described in Appendix B would be recommended and demonstrated, except for mesurol and DRC-1339. 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 are reasonably anticipated to be effective in resolving or reduce the predation occurring. Under this alternative, those persons requesting assistance would be provided information on the behavior of nest predators to ensure methods are applied when the use of those methods are likely to be most effective. For example, if live-capture of red fox is recommended using cage 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 similar to the other alternatives since the same methods would be available, except mesurol and DRC-1339. If methods are employed as intended and with regard to the behavior of nest predators, those methods are likely to be effective in resolving damage. The demonstration of methods and the information provided on nest predator behavior provided by WS through technical assistance under this alternative would likely increase the effectiveness of the methods employed by those persons requesting assistance. However, if methods are employed that are not recommended or if those methods are employed incorrectly by those persons requesting assistance, methods could be less effective in resolving predation.

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 in which all methods used to address nest predation are agreed upon. Methods employed to manage nest predation, whether non-lethal or lethal, are often 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. WS employs only those methods as agreed upon by the requestor after available methods are discussed.

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

Dispersing predators using pyrotechnics, repellents, 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 are temporary if habitat conditions remain unchanged. Dispersing and the translocating of nest predators could be viewed as moving a problem from one area to another which would require addressing damage caused by those predators at another location. WS' recommendation of or use of techniques to modifying existing habitat or making areas unattractive to nest predators is discussed in Appendix B. WS' objective is to respond to request for assistance with the most effective methods and to provide for the long-term solution to the problem using WS' Decision Model to adapt methods in an integrated approach to managing 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 methods to damage situations to effectively reduce or prevent damage from occurring. Under the proposed integrated approach, all methods, individually or in combination, could be employed as deemed appropriate through WS' Decision Model to address requests for assistance. WS' objective when receiving a request for assistance under the proposed action is to reduce 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 2 to 8 weeks. The re-application of non-lethal methods to disperse crow roosts was required every year to disperse crows from the original roost or from roosts that had formed in other areas where damages were occurring (Chipman et al. 2008). Some short-term methods may become less effective in resolving damage as a bird population increases, as birds become more acclimated to human activity, and as birds become habituated to harassment techniques (Smith et al. 1999, Chipman et al. 2008). Non-lethal methods often require a constant presence at locations when nest predators 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 which attract birds to a particular location (Gorenzel and Salmon 1995).

As addressed previous, the methods available for resolving nest predators would be similar across all the alternatives analyzed. Under the proposed action, the use of mesurol and DRC-1339 could occur by WS when deemed appropriate. Since all methods, except mesurol and DRC-1339, would be available under all the alternatives and when those methods are used as intended with consideration for the behavior of the target species, those methods would be considered effective.

WS typically institutes an integrated wildlife damage management program that utilizes a broad range of management tools. Lethal methods are used as a part of an integrated approach when non-lethal methods alone are 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[5]. 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 ability of an animal population to sustain a certain level of removal and to eventually return to pre-management levels does not mean individual management actions are unsuccessful, but that periodic management may be necessary. The return of wildlife to pre-management levels also demonstrates that limited, localized damage management methods have minimal impacts on a species' populations.

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

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. Methods of modifying habitat, excluding, frightening, or dispersing nest predators have been effective at specific sites in certain situations.

Non-lethal habitat modification or exclusion have the potential to reduce predation from one nest predator species may actually be beneficial to another nest predator species. Although effective at preventing predation from the first predator species, predation from the second species may actually be worse.

The use of auditory and visual dispersal methods used to reduce damage or threats caused by target species are temporary and nest predators would return after the cessation of dispersal methods. To be fully effective, those methods require constant application during the nesting season requiring extensive

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

man-hours to implement and/or remotely activated equipment that can disperse nest predators whenever they approach nest sites. The harassment and dispersal methods and the human presence to implement them are also likely to disperse the very nesting colonial waterbirds and T&E species being protected in the immediate area the methods are employed.

If breeding adults are preyed upon, nest sites or colonies are abandoned or eggs and chicks lost because adults are dispersed from the area, even temporarily due to harassment, the net effect may be the same as not conducting nest predator management.

Live traps (*e.g.*, cage traps, walk-in traps, foothold traps) restrain wildlife once captured and are considered live-capture methods and may be effective at managing predation. Translocation of live captured nest predators is generally not an option due to Massachusetts laws and regulations. Nest predators live captured could be placed into temporary captivity, possibly with licensed wildlife rehabilitators or zoos, and released at the capture site after the nesting season. However, these individuals may be difficult to capture in future years and would have to compete with new arrivals for their old territories making this option very similar to simple relocation. Although not currently registered in the Commonwealth, the chemical repellent mesurol could be employed by WS under this alternative if the product becomes registered. Nest predators could still be lethally taken during the regulated harvest season and as permitted by the MDFW under this alternative by property owners, managers and/or the general public where lawful.

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

Concerns are often raised regarding the effects that methods can have on human safety, either from direct exposure of the public to the method or indirectly from the public when encountering nest predators. The issue of human safety is discussed as it relates to each alternative in the following subsections.

Safety of Chemical Methods Employed

Alternative 1 – No Nest Predator Damage Management Conducted by WS

Under the no nest predator damage management alternative, WS would not be involved with any aspect of managing damage associated with nest predators, including technical assistance. Due to the lack of involvement in managing nest predation, no impacts to human safety would occur directly from WS. This alternative would not prevent other entities from conducting nest predator damage management activities in the absence of WS' assistance. The direct burden of implementing permitted methods would be placed on the property owners and/or managers.

Alternative 2 – Nest Predator Damage Management by WS through Technical Assistance Only

Under this alternative, WS would be restricted to making recommendations of methods and the demonstration of methods only to resolve 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 general public. Other chemical methods that could be available would be immobilizing and euthanizing drugs, pesticides, and repellents. Under this alternative, those drugs and chemicals would only be available to idividuals with appropriate licensing or certification. Immobilization and euthanization drugs receive limited use due to use regulations and the training requirements for their use. Use of pesticides and/or repellents would require individuals certified or licensed by the MDAR in applying restricted or general pesticides in accordance with Commonwealth laws and regulations. Immobilizing and euthanasia drugs, pesticides and repellents would be the same as those available under the proposed action alternative, with the exception of mesurol and DRC-1339.

Potential risks to human safety from the handling and use of immobilizing and euthanasia drugs, pesticides, and repellents are discussed under Alternative 3.

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, other registered toxicants and repellents such Avitrol, zinc phosphide, anti-coagulant rodenticides, euthanasia drugs, and immobilizing drugs. Chemical methods available under the proposed action are further described in Appendix B.

The primary application of immobilizing and euthanasia drugs occurs once a target species has been live-captured. Immobilization of live-captured mammalian and avian nest predators would occur to minimize stress and the likelihood of injury to the individual animal and for the safety of personnel handling the animal.

Immobilizing drugs could be used as non-lethal methods of capture under this alternative. Ketamine, telazol, and xylazine could be used to immobilize nest predators under this alternative. The primary application of immobilizing drugs occurs once a target species has been live-captured. Therefore, outside of transport and storage, the primary concern to human safety occurs to the handler and support staff during handling, drawing, and administering the drug. Immobilization of live-captured mammalian nest predators would occur to minimize stress and the likelihood of injury to the individual animal and for the safety of personnel handling the animal. Since the MDFW restricts the translocation of nest predators due to disease threats, mammalian nest predators would be immobilized primarily for transport to other locations where euthanasia would occur under this alternative. Immobilizing drugs would be administered according to recommended methods and doses from published sources (see Appendix B).

Euthanasia drugs would only be administered after the target animal has been properly restrained and immobilized and would occur through direct injection through a syringe. WS' personnel are required to attend training courses and be certified in the use of immobilizing and euthanizing drugs to ensure proper care and handling occurs, to ensure the proper doses is administered, and to ensure human safety.

Mesurol contains the active ingredient Methiocarb and is registered by the EPA for use to condition crows not to feed on the eggs of threatened and endangered species. Mesurol is currently not registered for use in Massachusetts but would be evaluated in this assessment as a repellent that could be employed under the proposed action or Alternative 4 if the product becomes available. Mesurol is mixed with water and once mixed, placed inside raw eggs that are similar in size and appearance to the eggs of the species being protected. Treated eggs are placed in the area where the protected species are known to nest at least 3 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. Human safety risks associated with the use of mesurol occur primarily to the mixer and handler during preparation. WS' personnel would follow all label requirements, including the personal protective equipment required to handle and mix bait. When used according to label requirements, the risks to human safety from the use of mesurol would be minimal.

Risks to human safety from the use of avicides and rodenticides could occur either through direct exposure of the chemical or exposure to the chemical from birds or rodents that have been lethally taken. The avicides DRC-1339 (3-chloro-p-toluidine hydrochloride) and Avitrol as well as zinc phosphide and a variety of anti-coagulant rodenticides are currently registered for use in Massachusetts and could be used for crow and Norway rat damage management. DRC-1339 is currently registered with the EPA to

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

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

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

Formulations of Avitrol come pre-applied to appropriate bait types for the target species, for crows, this is whole corn. Adherence to label requirements during the handling and application of Avitrol for use of

personal protective equipment ensures the safety of WS' personnel handling and applying treated bait. Therefore, risks to handlers and applicators that adhere to the personal protective equipment requirements of the label are low. Before application at bait locations, treated bait is mixed with untreated bait at ratiosrequired by the product label, generally 1:9, to minimize non-target hazards and to avoid bait aversion by target species.

Of additional concern is the potential exposure of people to crows harvested during the regulated hunting season that have ingested mesurol, DRC-1339 or Avitrol treated bait. The hunting season for crows in the Commonwealth during the development of this assessment occurred from July until mid-April the following calendar year with no daily take limit and no possession limit (MDFW 2011). Under the proposed action, baiting using mesurol, DRC-1339 and/or Avitrol to reduce crow damage could occur in the Commonwealth during the period of time when crows can be harvested.

When managing nest predation associated with crows, the use of mesurol, DRC-1339 or Avitrol would likely occur at known forage areas or in areas where crows have be conditioned to feed through the use of pre-baiting. Baiting with mesurol, DRC-1339 or Avitrol treated baits most often occurs during the late winter through spring when the availability of food may be limited but increasing and crows may be conditioned to feed consistently at a location by providing a consistent source of food. Given the range in which the death of sensitive bird species occurs, crows that consume treated bait could fly long distances. Although not specifically known for crows, sensitive bird species that ingest a lethal dose of DRC-1339 treated bait generally die within 24 to 72 hours after ingestion (USDA 2001). Therefore, crows that ingest a lethal dose of DRC-1339 at the bait site could die in other areas besides the roost location or the bait site. Mesurol and Avitrol intended to cause food aversion or repel flocks, work more quickly, Avitrol within a matter of hours. As a result, most crows that ingest a lethal dose of mesurol or Avitrol would die in relatively close proximity to the ingestion site.

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

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

requirements of DRC-1339. Residues DRC-1339 ingested by birds appears to be primarily located in the gastrointestinal tract of birds.

As stated previously, to pose of risks to human safety, a hunter would have to harvest a crow that has ingested DRC-1339 and then, ingest tissue of the crow containing residue. Very little information is available on the acute or chronic toxicity of DRC-1339 on people. However, based on the information available risks to human safety would be extremely low based on several mitigating factors. First, a hunter would have to harvest a crow that had ingested DRC-1339. As stated previously, the use of DRC-1339 primarily occurs to address damage associated with urban roosts. Hunting and discharging a firearm is prohibited in most municipal areas. Therefore, a crow would have to ingest treated bait and then travel to an area (typically outside of the city limit) where hunting was allowed. WS would not recommend hunting as a damage management tool in those general areas where DRC-1339 was actively being applied. Secondly, to pose a risk to human safety the crow would have to be consumed and the tissue consumed would have to contain chemical residues. Current information indicates that the majority of the chemical is excreted within a few hours of ingestion. The highest concentration of the chemical occurs in the gastrointestinal tract of the bird which is discarded and not consumed. Although residues have been detected in the tissues that might be consumed, 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 Massachusetts, very few, if any, people are likely consuming crows harvested in Massachusetts or elsewhere. Crows are hunted for recreation, and to alleviate agricultural damage. Crows harvested in Massachusetts, or elsewhere, are not (or "*are virtually never*") consumed (T. French, MDFW pers. comm. 2011).

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

All WS' personnel who handle and administer immobilizing drugs, euthanasia drugs, avicides, rodenticides and repellents would be properly trained. WS' employees handling and administering immobilizing and euthanasia drugs are required to be trained according to WS Directive 2.430. Training and adherence to agency directives would ensure the safety of employees administering any chemical methods. Nest predators euthanized by WS after the use of immobilizing and euthanasia drugs would be disposed of by deep burial or incinerated to ensure the risks to human safety from euthanized nest predators are minimal (see WS Directive 2.515). All euthanasia would occur in the absence of the public to further minimize risks. SOPs which further reduce risks to human safety are further described in Chapter 3 of this EA.

No adverse affects to human safety have occurred from WS' use of chemical methods to alleviate nest predators in Massachusetts from FY 2006 through FY 2010. The risks to human safety from the use of chemical methods, when used appropriately and by trained personnel, is considered low. Based on a thorough Risk Assessment, APHIS concluded that when chemicals are used according to label directions, they are selective to target individuals or populations, and such use has negligible impacts on the environment (USDA 1997).

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 for 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 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).

All personnel who handle and administered drugs would be properly trained. For WS' personnel, all employees handling and administering immobilizing and euthanizing drugs are required to be trained according to WS Directive 2.430. Training and adherence to agency directives would ensure the safety of employees administering any drugs. All immobilizing of mammalian nest predators using drugs would occur in the absence of the public to further minimize risks. SOPs are further described in section 3.4 of this EA.

Safety of Non-Chemical Methods Employed

Alternative 1 – No Nest Predator Damage Management Conducted by WS

Under the no involvement in nest predator damage management by WS alternative, WS would not be involved with any aspect of managing nest predation in the Commonwealth, 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 would occur directly. This alternative would not prevent other entities from conducting nest predator damage management activities in the absence of WS' involvement when permitted by the USFWS and/or the MDFW. Non-chemical methods discussed in Appendix B would be available to those persons experiencing damage or threats and could be used to take nest predators if permitted by the USFWS and/or the MDFW. The direct burden of implementing permitted methods would be placed on those persons requesting assistance.

Non-chemical methods available to alleviate or prevent damage associated with nest predators generally do not pose risks to human safety. Since most non-chemical methods available for nest predator damage management involve the live-capture of animals, those methods are generally regarded as posing minimal risks to human safety. Though some risks to safety are likely to occur with the use of pyrotechnics, propane cannons, and exclusion devices, those risks are minimal when those methods are used appropriately and in consideration of human safety. The only methods that involve the direct taking of mammalian nest predators are shooting, snap traps and conibear traps. Conibear traps would only be available for use on federal lands because they are restricted to use in controlling beaver and muskrat, unless muskrats were identified as a nest predator. Under this alternative, shooting and nest destruction would be available to those persons experiencing damage or threats of damage from avian nest predators when permitted by the USFWS and/or the MDFW. Firearms, when handled appropriately and with consideration for safety, pose minimal risks to human safety. Snap and conibear traps, when left undisturbed, would not pose risks to human safety.

Alternative 2 – Nest Predator Damage Management by WS through Technical Assistance Only

Under the technical assistance alternative, WS would only recommend the use of available non-chemical methods for managing damage 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 damage caused by nest predators in the Commonwealth.

Non-chemical methods available for use under the technical assistance only alternative are addressed in Appendix B.

Since those non-chemical methods discussed in Appendix B would be similar across the alternatives, the risks to human safety under a technical assistance alternative would be similar to those discussed in the no involvement by WS alternative (Alternative 1) and the non-lethal methods only alternative (Alternative 4) if methods are applied appropriately and in consideration of human safety.

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

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 local nest predator populations which could then reduce predation or threats would not increase risks to human safety. Safety requirements established by the USFWS and the MDFW for the regulated hunting and trapping season 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 damage and threats. When used appropriately and with consideration for human safety, risks associated with firearms are minimal. If firearms are employed inappropriately or without regard to human safety, serious injuries could occur. Under this alternative, recommendations of the use of firearms by WS would include human safety considerations. Since the use of firearms to alleviate 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 are employed according to recommendations and as demonstrated by WS, the potential risks to human safety would be similar to the proposed action. If methods are employed without guidance from WS or applied inappropriately, the risks to human safety could increase. The extent of the increased risk would be unknown and variable. Non-chemical methods inherently pose minimal risks to human safety given the design and the extent of the use of those methods.

Given the use profile of many methods to manage damage and threats associated with nest predators, the risks to human safety from the use of those methods are low (USDA 1997). The cooperator requesting assistance is also made aware of threats to human safety associated with the use of those methods. 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 as permitted by the USFWS and/or the MDFW. When requested under this alternative, WS would directly employ methods to alleviate or prevent nest predation from occurring in the Commonwealth. WS would also recommend non-chemical methods as part of a technical assistance program in an integrated approach to manage predation. WS' required training and directives ensure that those persons employing methods are 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 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 as part of an integrated approach to managing damage that would be employed as part of direct operational assistance by WS would be similar to those risks addressed in the other alternatives.

Non-chemical methods available for use under this alternative are discussed in Appendix B. As described previously, non-chemical methods do not result in direct take of nest predators, except for firearms and cable restraints. Most non-chemical methods involve the harassment or live-capturing of nest predators. Though some risks from harassment methods may occur, those risks are minimal when those methods are 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 measure which further reduces the risks to human safety when WS is directly involved with applying those methods is the knowledge and training received by WS' personnel. WS' employees who would conduct nest predator damage management activities are knowledgeable in the use of methods, wildlife species responsible for causing damage or threats, and WS' directives. That knowledge is incorporated into the decision-making process inherent with the WS' Decision Model that is applied when addressing nest predation. When employing lethal methods, WS' employees would consider risks to human safety when employing those methods based on location and method. Consideration is also given to the location where damage management activities would be conducted based on property ownership. If locations where methods would be employed occur on private property in rural areas where access to the property is controlled and monitored, the risks to human safety from the use of methods is likely less. If damage management activities occur at parks or near other public use areas, then risks of the public encountering damage management methods and the corresponding risk to human safety increases.

Safety issues may arise from the misuse of firearms and the potential human hazards associated with firearms use when employed to reduce damage and threats. To help ensure safe use and awareness, WS' employees who use firearms to conduct official duties are required to attend an approved 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 are deemed appropriate to alleviate or reduce damage and threats to human safety when conducting activities. WS and cooperating agencies would work

closely with cooperators requesting assistance to ensure all safety issues are considered before firearms are deemed appropriate for use. After evaluation of the damage or threat of damage associated with the request for assistance using the WS' Decision Model, the WS employee would determine which methods were appropriate for reducing damage or threats of damage 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. A risk assessment conducted during the development of WS' programmatic FEIS, determined the risks to human safety from the use of firearms was low based on the use profile of the method (USDA 1997).

The use of restraining devices has also been identified as a potential issue. Restraining devices include cage traps, conibear traps, cable restraints and foothold traps. These devices pose minimal risks to the public when used appropriately and several of these devices would only be available for use on federal lands, due to Massachusetts restriction on their use, further reducing their risk to the public. Restraining devices are typically set in areas where human activity is 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 are 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 are not located in high-use areas to ensure the safety of the public and pets. An APHIS risk assessment in WS' programmatic FEIS concluded that threats to human safety from the use of devices to restrain wildlife were low (USDA 1997).

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

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 damage are intended to disperse and/or remove those predators predating on eggs, nestlings, and adults. Non-lethal methods are intended to exclude or other make an area less attractive which disperses those animals to other areas. Similarly, lethal methods are intended to remove those individual animals identified as causing damage or posing a threat of damage. The effects on the aesthetic value of those species as it relates to the alternatives are discussed below.

Alternative 1 – No Nest Predator Damage Management Conducted by WS

Under the no nest predator damage management by WS alternative, the actions of WS would have no impact on the aesthetic value of nest predators in the Commonwealth. Those entities where predation is occurring would be responsible for researching, obtaining, and using all methods as permitted by federal, Commonwealth, and local laws and regulations. Nest predators would continue to be dispersed and lethally taken under this alternative in the Commonwealth. Lethal take would continue to occur during the regulated harvest season and through the blackbird depredation order.

Since nest predators would 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 lead to a reduction in the number of nest predators dispersed or taken since WS' has no authority to regulate take or the harassment of those animals in the Commonwealth. The USFWS and the MDFW with management authority over those wildlife species would continue to adjust all take levels based on population objectives for those species. Therefore, the number of nest predators lethally taken annually through hunting, trapping, and under the depredation order are regulated and adjusted by the USFWS and the MDFW.

Nest predation damage management would continue to occur when deemed appropriate by other entities. Those methods they feel appropriate to resolve nest predation, including lethal take would continue to be employed. WS' involvement in nest predator damage management is therefore, would not be additive to the number of those nest predators already taken in the Commonwealth. The impacts to the aesthetic value of nest predators would be similar to the other alternatives.

Alternative 2 – Nest Predator Damage Management by WS through Technical Assistance Only

If those persons seeking assistance from WS were those persons likely to conduct nest predator damage management 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 Commonwealth similar to Alternative 1. Nest predators could be lethally taken under this alternative which would result in localized reductions in the presence of those species at the location where damage was occurring. The presence of predators in areas where predation was occurring would be reduced where damage management activities are conducted under any of the alternatives. Even the recommendation of non-lethal methods is likely to result in the dispersal of nest predators from the area if those non-lethal methods recommended by WS are employed by those persons receiving technical assistance. Therefore, technical assistance provided by WS would not prevent the aesthetic enjoyment of 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. Based on recommendations, methods are likely to be employed by the requestor based on those recommendations that would result in the dispersal and/or removal of a nest predator.

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

severely limited since those species 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 damage and threats. In some instances where nest predators are dispersed or removed, the ability of interested persons to observe and enjoy those individual animals would likely temporarily decline.

Even the use of exclusionary devices can lead to dispersal of wildlife if the resource being damaged 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.

The use of lethal methods would result in temporary declines in local populations resulting from the removal of predators to address nest predation. The goal under the proposed action is to respond to requests for assistance and to manage those individual animals responsible for nest predation. Therefore, the ability to view and enjoy those nest predators would still remain if a reasonable effort is made to locate nest predators outside the area in which damage management activities occurred. Those nest predators removed by WS are those individual animals that could be removed by the person experiencing damage with the appropriate permit issued by the MDFW for mammalian predators or under the blackbird depredation orders for crows, or during the regulated hunting and trapping seasons.

All nest predator management activities are conducted by WS where a request for assistance has been received and only after agreement for such services have been agreed upon by the cooperator with the intent of increasing populations of T&E species. 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. Thus increasing the ability of interested persons to observe and enjoy individuals of rare and/or T&E species. Any removal of nest predators by WS using lethal methods in the Commonwealth would occur after the appropriate permits are received, when necessary.

Since those nest predators removed by WS under this alternative could be 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.

WS' take of nest predators from FY 2006 through FY 2010 has been of low magnitude when compared to the total mortality from other sources. WS' activities are not likely additive to the nest predators that would be taken in the absence of WS' involvement. Although individual animals removed by WS are no longer present for viewing or enjoying, those animals would likely be taken by the property owner or manager under the permit issued to the owner or manager by the MDFW, 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' nest predator damage management 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 is likely 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, and dispersal of nest predators from areas where damage was occurring. The use of non-lethal methods would result in the dispersal or exclusion of predators from areas where predation was occurring. The number of nest predators present in those areas would be reduced and those individual animals dispersed or excluded would no longer be available for viewing in the area where predation was occurring.

Those methods would also be available to the person experiencing damage or threats in the absence of WS' direct involvement. The MDFW 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. The take of nest predation would continue despite WS' use of only non-lethal methods. Therefore, the number of nest predators taken annually would be similar under all the alternatives despite the use of non-lethal methods by WS.

Although nest predators would be dispersed or excluded under this alternative, those species could still be viewed and enjoyed under this alternative if a reasonable effort if made to find those species outside the area where predation was occurring. 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 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.

Alternative 1 – No Nest Predator Damage Management Conducted by WS

Under this alternative, WS would have no involvement in any aspect of nest predator damage management in the Commonwealth. Other entities could continue to use those methods legally available when permitted by the USFWS, the MDFW, and other federal, Commonwealth, and local regulations. Those methods would likely be considered inhumane by those persons who would consider methods proposed under any alternative as inhumane. The issue of humaneness would likely be directly linked to the methods legally available to the general public since methods are often labeled as inhumane by segments of society no matter the entity employing those methods. A method considered inhumane, would still be perceived as inhumane regardless of the person or entity applying the method. However, even methods generally regarded as being a humane method could be employed in inhumane ways if employed by those persons inexperienced in the use of those methods or if those persons are not as diligent in attending to those methods.

The efficacy and therefore, the humaneness of methods would be based on the skill and knowledge of the person employing those methods. A lack of understanding of the target species or methods used could lead to an increase in situations perceived as being inhumane to wildlife despite the method used. Despite the lack of involvement by WS under this alternative, those methods perceived as inhumane by certain individuals and groups would still be available to the general public to use. Therefore, those methods

considered inhumane would continue to be available for use under this alternative. If those persons apply those methods considered to be humane methods as intended and in consideration of the humane use of those methods, then the issue of method humaneness would be similar across the alternatives. If persons employ humane methods in ways that are inhumane, the issue of method humaneness could be greater under this alternative if those persons are not provided with information and demonstration on the proper use of those methods. However, the level at which people would apply humane methods inhumanely under this alternative based on a lack of assistance is difficult to determine and could just as likely be similar across the alternatives. Similar to Alternative 2, the lack of understanding of predator behavior or proper method use could lead to situations where methods are employed that could be perceived as inhumane.

Alternative 2 – Nest Predator Damage Management by WS through Technical Assistance Only

The issues of humaneness of methods under this alternative are likely to be perceived to be similar to humaneness issues discussed under the proposed action. This perceived similarity is derived from WS' recommendation of methods that some consider inhumane. WS would not directly be involved with damage management activities under this alternative. However, the recommendation of the use of methods would likely result in the 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 and to ensure methods are used in such a way as to minimize pain and suffering. However, the efficacy of methods employed by a cooperator would be based on the skill and knowledge of the requestor in resolving the threat to safety or damage situation despite WS' demonstration. Therefore, a lack of understanding of the behavior of nest predators or improperly identifying the damage caused by nest predators along with inadequate knowledge and skill in using methodologies to resolve the predation could lead to incidents with a greater probability of being perceived as inhumane. In those situations, the pain and suffering are likely to be regarded as greater than those discussed in the proposed action.

Those persons requesting assistance would be directly responsible for the use and placement of methods and if monitoring or checking of those methods does not occur in a timely manner, captured wildlife could experience suffering and if not address timely, could experience distress. The amount of time an animal is restrained under the proposed action would be shorter compared to a technical assistance alternative if those requestors implementing methods are not as diligent or timely in checking methods. Similar to Alternative 1, it is difficult to evaluate the behavior of individual people and what may occur under given circumstances. Therefore, only the availability of WS' assistance can be evaluated under this alternative since determining human behavior can be difficult. If those persons seeking assistance from WS apply methods recommended by WS through technical assistance as intended and as described by WS, then those methods would be applied as humanely as possible to minimize pain and distress. If those persons provided technical assistance by WS apply methods not recommended by WS or do not employ methods as intended or without regard for humaneness, then the issue of method humaneness would be of greater concern since pain and distress of 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 which are generally regarded as humane. Non-lethal methods on federal and non-federal lands would include resource management methods (*e.g.*, limited habitat modification, modification of human behavior), nest destruction, exclusion devices, frightening devices, cage traps, foothold traps, restraining cables with stops, and repellents.

As discussed previously, humaneness, in part, appears to be a person's perception of harm or pain inflicted on an animal. People may perceive the humaneness of an action differently. The challenge in coping with this issue is how to achieve the least amount of animal suffering.

Some individuals believe any use of lethal methods to resolve damage associated with wildlife is inhumane because the resulting fate is the death of the animal. Others believe that certain lethal methods can lead to a humane death. Others believe most non-lethal methods of capturing wildlife to be humane because the animal is generally unharmed and alive. Still others believe that any disruption in the behavior of wildlife is inhumane. With the multitude of attitudes on the meaning of humaneness and the varying perspectives on the most effective way to address damage and threats in a humane manner, agencies are challenged with conducting activities and employing methods that are perceived to be humane while assisting those persons requesting assistance to manage damage and threats associated with wildlife. The goal of WS is to use methods as humanely as possible to effectively resolve requests for assistance to reduce damage and threats to human safety. WS would continue to evaluate methods and activities to minimize the pain and suffering of methods addressed when attempting to resolve requests for assistance.

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

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

If nest predators are to be live-captured by WS, WS' personnel would be checked frequently to ensure those nest predators captured are addressed timely and to prevent injury. Although stress could occur from being restrained, timely attention to live-captured wildlife would alleviate suffering. Stress would likely be temporary.

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 and immobilizing drugs, the stress of animals is likely temporary.

Under the proposed action, lethal methods could also be employed to resolve requests for assistance to resolve or prevent nest predation. Lethal methods available on federal and non-federal lands would include shooting, conibear traps, snap traps, DRC-1339, mesurol, Avitrol and euthanizing methods. WS'

use of euthanasia methods under the proposed action would follow those required by WS' directives (see 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). The external appearances and behavior of starlings that ingested DRC-1339 slightly above the LD_{50} for starlings appeared normal for 20 to 30 hours, but water consumption doubled after 4 to 8 hours and decreased thereafter. Food consumption remained fairly constant until about 4 hours before death, at which time starlings refused food and water and became listless and inactive. The birds perched with feathers fluffed as in cold weather and appeared to doze, but were responsive to external stimuli. As death nears, breathing increased slightly in rate and became more difficult; the birds no longer responded to external stimuli and became comatose. Death followed shortly thereafter without convulsions or spasms (DeCino et al. 1966). Birds ingesting a lethal dose of DRC-1339 become listless and lethargic, and a quiet death normally occurs in 24 to 72 hours following ingestion. This method appears to result in a less stressful death than which probably occurs by most natural causes, which are primarily disease, starvation, and predation. In non-sensitive birds and mammals, central nervous system depression and the attendant cardiac or pulmonary arrest is the cause of death (Felsenstein et al. 1974). DRC-1339 is the only lethal method that would not be available to other entities under the other alternatives. DRC-1339 to manage damage caused by crows is only available to WS' personnel for use.

Mesurol and Avitrol are not intended to be used as toxicants but as aversive and repellent agents respectively. However, their mode of action may result in the lethal take of a limited number of individuals. Unlike DRC-1339 which requires a relatively long period to cause death; mesurol and Avitrol cause rapid, acute toxicity. The individuals that consume treated bait either recovery fully and develop an aversion to the bait type consumed or die quickly while repelling others of their species from the bait type and/or area of treatment. Although some individuals may die, the overall effect is a reduced need to conduct lethal control.

Research and development by WS has improved the selectivity and humaneness of management techniques. Research is continuing to bring new findings and products into practical use. Until new findings and products are found practical, a certain amount of animal suffering could occur when some methods are used in situations where non-lethal damage management methods are not practical or effective. Personnel from WS are experienced and professional in their use of management methods. Consequently, management methods are implemented in the most humane manner possible under the constraints of current technology. Those methods discussed in Appendix B to alleviate nest predation in the Commonwealth, except for DRC-1339 and mesurol, could be used under any of the alternatives regardless of WS' direct involvement. Therefore, the issue of humanness associated with methods would be similar across any of the alternatives since those methods could be employed. Those persons who view a particular method as humane or inhumane would likely continue to view those methods as humane or inhumane under any of the alternatives. SOPs that would be incorporated into WS' activities to ensure methods are used by WS as humanely as possible are listed in Chapter 3.

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 are used in situations where non-lethal damage management methods are 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 are generally regarded as humane. Non-lethal methods would include resource management methods (*e.g.*, crop selection, minor habitat modification, modification of human behavior), exclusion devices, frightening devices, live traps, foothold, and repellents.

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

The applicability of cage traps, foothold traps, 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 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 and would cease once the animal was released.

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

Another common concern is the potential effects of damage management activities on the ability to harvest target species during the regulated hunting and trapping season in the Commonwealth. Those species addressed in the assessment have a socio-cultural value as a harvestable game species sought by hunters and trappers who often pass the tradition on to family members or are members of sportsman's or hunting clubs providing social interaction with other sportsmen.

Methods intended to disperse or remove target species from an area where predation is occurring which could reduce the opportunities to harvest those species during the regulated harvest seasons. All of the species addressed in this assessment can be harvested in the Commonwealth during hunting and trapping seasons.

Alternative 1 – No Nest Predator Damage Management Conducted by WS

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 nest predator damage management. The USFWS and the MDFW would continue to regulate populations through adjustments of the allowed take during the regulated harvest seasons and the continued use of the depredation order.

Alternative 2 – Nest Predator Damage Management 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 MDFW and for crows, under the blackbird depredation order established by the USFWS resulting in impacts 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 damage

management area. 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 in 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 MDFW would determine the number of mammalian nest predators taken annually by WS through the issuance of permits. Also, those nest predators removed by WS are those that could be removed by other entities when permitted by the MDFW.

Nest predator damage management activities conducted by WS would occur after consultation and approval by the MDFW. With oversight by the MDFW, the number of mammalian nest predators allowed to be 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 MDFW and the USFWS annually to ensure take by WS is incorporated into population management objectives established for those species.

Additionally, WS often conducts control in areas where hunting is not a viable option such as parks, public beaches and National Wildlife Refuges. In those cases, nest predators being lethally removed are not available for hunting or trapping and those dispersed may actually move to areas where hunting or trapping is allowed. Therefore, the ability to hunt and trap nest predators may actually increase if a reasonable effort is made to locate those species outside the area in which damage management activities occurred.

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 damage management area. However, the populations of those species would be unaffected by WS under this alternative.

Issue 9 - Effects on Recreation in Areas Where Damage Management Activities are Conducted

Another concern is the potential effects on recreation activities at areas where damage management activities are conducted in the Commonwealth beyond harvesting through legal hunting and trapping. Areas used for nesting by T&E species and colonial birds are often utilized for a wide variety of recreational activities to include but not be limited to swimming, hiking, dog walking, fishing, off road/all terrain vehicle use, picnicking and bird/wildlife watching.

Alternative 1 – No Nest Predator Damage Management Conducted by WS

WS would have no impact on the ability to utilize nesting areas for any recreational activity. WS would not be involved with any aspect of nest predator damage management. The USFWS, the MDFW and other federal, state and municipal agencies and private landowner and/or resource managers would

continue to regulate recreational access to areas with current or historic nesting habitat during the nesting seasons. These restrictions would be based on federal and Commonwealth laws and regulations as well as agency or landowner policy or preference.

Alternative 2 – Nest Predator Damage Management by WS through Technical Assistance Only

WS would have no direct impact on the recreational activity since WS would not be responsible for restricting recreational access to any sites. However, WS might recommend restricting recreational access to resource/property owners/managers to reduce impacts to nesting colonial birds and/or T&E species or during control activities being conducted by other entities resulting in impacts similar to the proposed action and the other alternatives. However, any closure or restriction would be made at the discretion of the property owner/manager. Restrictions may be based on safety concerns due to control methods such as shooting implemented by property owner/manager.

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

Nest predator management activities would mostly occur from February through June and would have little impact on recreation activities that take place during the summer months. However, during the nesting season most local areas with current nesting activity and many with historic nesting activity are closed to public access by both private and public property owners and/or resource managers to limit damage to nesting habitat and disturbance of nesting birds or survival of fledglings; thereby, affecting those persons that would potentially use those areas for recreational activities. These access restrictions occur regardless of whether or not WS nest predator management activities occur or not. Swimming, sunbathing, and picnics would probably not be affected by nest predator management activities because those activities typically occur during warmer temperatures in summer months.

WS is not a land or resource management agency and does not have the authority to restrict access for recreation or any other purpose at any site. This authority exists with the property owner/resource manager or under the authority of the USFWS and/or MDFW to protect T&E species. As a result, maintaining an integrated approach to managing nest predation by WS through technical assistance and direct operational management would not have a direct impact on recreational access. WS may recommend that access be limited or restricted such as requiring dogs to be leashed or closing an area of beach during shooting, however the ultimate decision would not lie with WS.

Similar to Alternative 2, restrictions may implemented by the property owner/manager be based on safety concerns due to control methods implemented. This may be the case whether control is conducted by the property owner/manager based on WS technical assistance or directly by WS under a cooperative service agreement, MOU or other comparable agreement.

In the short term WS nest predator management activities may result in an increase in the local population of T&E species that could result in limited or restricted access over a larger area. However, the long term goal of nest predator management and managing T&E and at risk species is to achieve population recovery. If T&E species rebound to levels where delisting can occur due to recovery, access restrictions may ultimately be reduced or in some cases even eliminated.

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

Similar to the Alternative 1 and Alternative 2, WS would have no impact on recreation since WS would not ultimately be responsible for limiting or restricting access. The use and recommendation of non-lethal methods by WS under this alternative would not limit the ability of those persons interested in

recreational activity in the damage management area. This could only be done by the resource/property owner.

4.2 CUMULATIVE IMPACTS OF THE PROPOSED ACTION BY ISSUE

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

Under Alternative 2, Alternative 3, and Alternative 4, WS could address damage 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 Commonwealth. WS would be the primary agency conducting direct operational nest predator damage management in the Commonwealth under Alternative 2, Alternative 3, and Alternative 4. However, other federal, Commonwealth, and private entities could also be conducting nest predator damage management in the Commonwealth. The take of mammalian nest predators requires a permit from the MDFW, which requires permit holders to report all take occurring under the permit. Take of crows occur under the established blackbird depredation order.

WS does not normally conduct direct damage management activities concurrently with such agencies or other entities in the same area, but may conduct nest predator damage management activities at adjacent sites within the same time frame. The potential cumulative impacts analyzed below could occur either as a result of WS' damage management program activities over time, or as a result of the aggregate effects of those activities combined with the activities of other agencies and private entities. Through ongoing coordination and collaboration between WS, the USFWS, and the MDFW, activities of each agency and the take of nest predators would be available. Nest predator damage management activities in the Commonwealth would be monitored annually to evaluate and analyze activities to ensure they are within the scope of analysis of this EA.

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

Evaluation of activities relative to target species indicated that program activities would likely have no cumulative adverse affects 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 are not limited to:

- Natural mortality of wildlife
- Human-induced mortality of wildlife through private damage management activities
- 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 to cause damage to resources. The actions taken to minimize or eliminate damage are constrained as to scope, duration, and intensity for the purpose of minimizing or avoiding impacts to the environment. WS uses the Decision Model to evaluate damage occurring, including other affected elements and the dynamics of the damaging species; to determine appropriate strategies to minimize effects on environmental elements; applies damage management actions; and

subsequently monitors and adjusts/ceases damage management actions (Slate et al. 1992). This process allows WS to take into consideration other influences in the environment, such as those listed above, in order to avoid cumulative adverse impacts on target species.

With management authority over wildlife populations, the USFWS and the MDFW 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 MDFW considers any activities conducted by WS.

WS' take of nest predators in Massachusetts from FY 2006 through FY 2010 was of a low magnitude when compared to the total known take. The USFWS and the MDFW considers all known take when determining population objectives for the populations of those species and can adjust the number of nest predators that can taken for damage management purposes to achieve the population objectives. Any take by WS would occur at the discretion of the USFWS and the MDFW. Any population declines or increases that are associated with damage management activities would be the collective objective for wildlife populations established by the USFWS and the MDFW 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 MDFW as part of management objectives for those species in the Commonwealth.

No cumulative adverse impacts are expected from WS' nest predator damage management actions based on the following considerations:

1. Historical outcomes of WS' damage management activities on wildlife

Wildlife damage management activities are conducted by WS only at the request of a cooperator to reduce damage that is occurring or prevent damage from occurring and only after methods to be used are agreed upon by all parties involved. WS' annually monitors activities to ensure any potential impacts are identified and addressed. WS works closely with Commonwealth and federal resource agencies to ensure damage management activities are not adversely impacting wildlife populations and that WS' activities are considered as part of management goals established by those agencies. Historically, WS' activities to manage nest predation in Massachusetts have not reached a magnitude that would cause adverse impacts to wildlife populations in the Commonwealth.

2. 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 which could result from unforeseen environmental changes. This would include those changes occurring from sources other than WS. Alterations in programs are defined through SOPs and implementation is insured through monitoring, in accordance with the WS' Decision Model (Slate et al. 1992).

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

Potential effects on non-target species from conducting nest predator damage management 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 are often expensive and 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 or nesting sites. The use of visual and auditory harassment and dispersion methods are generally temporary with non-target species returning after the cessation of those activities. Dispersal and harassment do not involve the take (killing) of non-target species and similar to exclusionary methods are not used to the extent or at a constant level that would prevent non-targets from accessing critical resources that would threaten survival of a population.

The use of lethal methods or those methods used to live-capture target species followed by euthanasia also have the potential to impact non-target wildlife through the 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 relocation is currently not allowed by the MDFW without a permit. With all live-capture devices, non-target wildlife captured can be released on site if determined to be able to survive following release. SOPs are intended to ensure take of non-target wildlife is minimal during the use of methods to capture target wildlife.

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

Chemical methods available for use under the proposed action are repellents, aversive agents, DRC-1339, immobilizing drugs, and euthanasia drugs which are described in Appendix B. Except for immobilizing and euthanasia drugs which are applied directly to the target species, all chemical methods are employed using baits that are highly attractive to target species and used in areas where exposure to non-targets are minimal. The use of those methods requires an acclimation period and monitoring of potential bait sites for non-target activity. All chemicals would be used according to product label which ensure that proper use would minimize non-target threats. WS' adherence to Directives and SOPs governing the use of chemicals also ensures non-target hazards are minimal.

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

All label requirements of those chemical methods would be followed to minimize non-target hazards. As required by the label for Avitrol, DRC-1339 and mesurol, an acclimation period occurs and sites are monitored for non-target use as outlined in the label. If birds are observed feeding on bait, those sites are abandoned. All unconsumed bait must be retrieved after application.

The methods described in Appendix B all have a high level of selectivity and can be employed using SOPs to ensure minimal impacts to non-targets species. No non-targets were taken by WS during nest predator damage management activities from FY 2006 through FY 2010. Based on the methods available to resolve nest predator damage and/or threats, WS does not anticipate the number of non-targets taken to reach a magnitude where declines in those species' populations would occur. Therefore, take under the

proposed action of non-targets would not cumulatively impact non-target species.

Issue 3 – Effects of Damage Management Activities on Threatened and Endangered Species

The methods described in Appendix B all have a high level of selectivity and can be employed using SOPs to ensure minimal impacts to non-targets species. No T&E species have been adversely affected from previous activities conducted by WS during nest predator damage management activities from FY 2006 through FY 2010. WS' has reviewed the T&E species listed by the MDFW, the USFWS, and the National Marine Fisheries Services. WS has determined that the proposed activities would benefit those ground nesting speces listed by the USFWS in the Commonwealth and would conduct site specific consultations with the USFWS before work would be conducted. WS would abide by any recommendations made during the consultation process. In addition, WS has determined that the proposed activities would benefit those ground nesting bird species listed by the MDFW that nest along the beaches and coastal islands in the Commonwealth and would have no effect on other listed species in the Commonwealth.

Issue 4 - Effectiveness of Nest Predator Damage Management

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

Effectiveness is based on the types of methods employed, the application of the method, restrictions on the use of the method(s), the skill of the personnel using the method and, for WS' personnel, the guidance provided by WS' Directives and policies. The goal of the WS' program is to reduce damage, risks, and conflicts with wildlife as requested. WS recognizes that localized population reduction could be short-term and that new individuals may immigrate, be released at the site, or be born to animals remaining at the site (Courchamp et al. 2003). The ability of an animal population to sustain a certain level of removal and to eventually return to pre-management levels, however, does not mean individual management actions are unsuccessful, but that periodic management may be necessary.

Correlated with the effectiveness of methods at reducing or alleviating damage are the costs associated with applying methods to reduce damage or threats. If methods are ineffective at reducing or alleviating damage or if methods require re-application after initially being successful, the costs associated with applying those methods increases. An analysis of cost-effectiveness in many wildlife damage management situations is difficult or impossible to determine because the value of benefits may not be readily calculable and personal perspectives differ about damage.

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

In regards to the effectiveness of methods used, Avery (2002) cited studies where lethal damage management reduced losses to crops (Elliott 1964, Larsen and Mott 1970, Palmer 1970, Plesser et al.

1983, Tahon 1980, Glahn et al. 2000*a* as cited in Avery 2002) and those lethal methods posed little danger to non-target species (Glahn et al. 2000*a*). Avery (2002) also stated that it seems reasonable that local, short-term crop protection can be achieved through reduction in depredating bird populations; however, quantification of the relationship between the numbers of birds killed and the associated reduction in crop damage is lacking. Avery (2002) stated that studies demonstrating economic benefit from the use of lethal methods are lacking but did not state that lethal methods to resolve damage are not economically effective. Many publications indicate that the use of non-lethal methods require repeated application to achieve the desired result (see Smith et al. 1999, Gorenzel et al. 2000, Gorenzel et al. 2002, Avery et al. 2008, Chipman et al. 2008). Long-term solutions to resolving bird damage often require management of the population (Smith et al. 1999) and identifying the habitat characteristics which attract birds to a particular location (Gorenzel and Salmon 1995).

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. WS' programmatic FEIS (USDA 1997) states:

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

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

Concern is often raised that nest predators only return to an area where damage was occurring if lethal methods are used which creates a financial incentive to continue the use of only lethal methods. However, as stated throughout the EA, the use of non-lethal methods are also often temporary which could result in nest predators returning to an area where damage was occurring once those methods are no longer used. Nest predators would return if suitable habitat continues to exist at the location where damage was occurring and densities are sufficient to occupy all available habitats. Therefore, any reduction or prevention of damage from the use of methods addressed in the EA would be temporary if habitat conditions continue to exist. Any method that disperses or removes 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 which increases costs, moves those nest predators to other areas where they could cause damage, and are 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 is to respond to request for assistance with the most effective methods and to provide for the long-term solution to the problem using WS' Decision Model to adapt methods in an integrated approach to managing 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

All non-chemical methods described in Appendix B are used within a limited time frame, are not residual, and do not possess properties capable of inducing cumulative adverse impacts on human health and safety. All non-chemical methods are used after careful consideration of the safety of those persons employing methods and to the public. All capture methods are employed where human activity is minimal to ensure the safety of the public. All methods are agreed upon by the requesting entities which are made aware of the safety issues of those methods when entering into a MOU, cooperative service agreement, or other comparable document between WS and the cooperating entity. SOPs also ensure the safety of the public from those methods used to capture or take wildlife. A formal risk assessment conducted by APHIS determined that WS' non-chemical methods, when used as intended, poses a low risk to human safety (USDA 1997). Firearms used to alleviate or prevent predation, though hazards do exist, are employed to ensure the safety of employees and the public.

WS has received no reports or documented any adverse affects to human safety from WS' nest predation damage management activities conducted from FY 2006 through FY 2010. Personnel employing non-chemical methods would continue to be trained to be proficient in the use of those methods 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 impact human safety.

All pyrotechnics would be tracked and recorded to ensure proper accounting of used and unused inventory. All pyrotechnics would be stored, transported and distributed according to ATF regulations and the directives of WS.

Chemical Methods

Chemical methods available for use under the proposed action are mesurol, DRC-1339, Avitrol, repellents, euthanasia drugs, and immobilizing drugs. Immobilizing and euthanasia drugs are administered to target individuals using methods that ensure the identification of the target animal. Euthanasia methods would only be administered after wildlife has been properly restrained. WS' personnel are required to attend training courses and be certified in the use of immobilizing drugs and euthanasia methods to ensure proper care and handling occurs, to ensure the proper doses are administered, and to ensure human safety. WS' personnel would continue to be trained in the proper handling and administering of immobilizing drugs and euthanasia methods to ensure human safety.

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

DRC-1339 exhibits a low persistence in soil or water, and bioaccumulation of the chemical is unlikely (USDA 1997). Additionally, the relatively small quantity of DRC-1339 that could potentially be used in crow damage management programs in Massachusetts, 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 2005 through FY 2008, WS has used 95.4 grams of DRC-

1339 during bird damage management activities. DRC-1339 has not been used previously by WS to manage crow damage. Previous uses of DRC-1339 by WS occurred to alleviate pigeon and starling damage. The use of DRC-1339 under the proposed action and in other bird damage management activities is not expected to increase to a level that adverse affects 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 Massachusetts.

All chemical methods would be tracked and recorded to ensure proper accounting of used and unused chemicals occurs. All chemicals would be stored and transported according to FDA, Department of Transportation, and the Drug Enforcement Agency regulations, including the directives of WS. The amount of chemicals used or stored by WS would be minimal to ensure human safety.

No adverse affects have been report to or identified by WS from the use of chemical methods during nest predator damage management conducted by WS from FY 2006 through FY 2010. When chemical methods are applied as intended and when safety guidelines are followed, no adverse affects to human safety are 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, Commonwealth, 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

No cumulative effects are anticipated on socio-cultural elements of the human environment due to impacts to target species populations. WS anticipates no effect on regional populations of target species due to control activity and local populations should recover once control activities cease.

The purpose of WS nest predator management is to improve populations of rare and/or T&E species with overall goal of species recovery and delisting. Species recovery and delisting would have a significantly positive effect on the human environment by maintaining natural biodiversity and ensuring native species are present in the environment.

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.

Methods involving the use of live-capture devices, chemicals, and euthanasia methods occur while WS' personnel are present on the site to ensure any wildlife confined or restrained are addressed in a timely manner to minimize distress of the animal. All euthanasia methods used for live-captured nest predators 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 nest predators taken by this method.

WS employs methods as humanely as possible by applying measures to minimize pain and that allow wildlife captured to be addressed in a timely manner to minimize distress. Through the establishment of SOPs that guide WS in the use of methods to address damage and threats associated with nest predators in the Commonwealth, 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 Damage Management Activities on the Regulated Harvest of Those Species

As discussed previously in this EA, the magnitude of WS' take for damage management purposes from FY 2006 through FY 2010 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 either the USFWS and/or the MDFW, the take of nest predators by WS that would occur annually and cumulatively would occur pursuant to population objectives established by the USFWS and the MDFW. 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 MDFW maintains the ability to regulate take by WS to meet management objectives for those species in the Commonwealth. Therefore, the cumulative take of nest predators is considered as part of the USFWS and MDFW objectives for those species' populations in the Commonwealth. Any changes in the population of those species in the Commonwealth would occur at the direction and the discretion of the USFWS and the MDFW since all take by WS occurs only when a permit has been issued for the take by MDFW and only when permitted by the USFWS.

Issue 9 - Effects on Recreation in Areas Where Damage Management Activities are Conducted

As discussed in the EA, WS has no regulatory authority to limit or restrict access for recreational activity on any property. Limiting or restricting access for recreational purposes is solely the responsibility of property owners/managers and/or the USFWS and MDFW the resource management agencies responsible for implementing federal and Commonwealth endangered species law.

CHAPTER 5 - LIST OF PREPARERS AND PERSONS CONSULTED

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APPENDIX A
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APPENDIX B
PREDATOR MANAGEMENT METHODS AVAILABLE FOR USE OR RECOMMENDATION BY THE MASSACHUSETTS WILDLIFE SERVICES PROGRAM

HABITAT MANAGEMENT METHODS

State and federal wildlife and resource managers and property owner practices; these consist primarily of nonlethal preventive methods such as habitat modification. Habitat modification techniques are implemented by the state and federal wildlife and resource managers or private property owners/managers. Resource owners/managers may be encouraged to use these methods, based on the level of risk, need, and professional judgment on their effectiveness and practicality.

Environmental/Habitat modification can be an integral part of PM. Wildlife production and/or presence is 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 or to repel certain animals. In most cases, the resource or property owner is responsible for implementing habitat modifications, and WS only provides advice on the type of modifications that have the best chance of achieving the desired effect. Habitat management is most often a primary component of PM strategies by eliminating crow, grackle and gull nesting, roosting, loafing, or feeding sites; or coyote, fox, and raccoon denning sites.

There are probably few habitat modifications that could be implemented to reduce coyote, red and gray fox, and raccoon, skunk, and opossum abundance because these species are highly adaptable generalists. One possible habitat modification that could affect raccoon abundance on some islands is razing abandoned buildings used by raccoons as dens and excluding buildings occupied by people. Other habitat modification such as the elimination of dense vegetation used as coyote, red and gray fox, and raccoon den sites would be harmful to other wildlife species or affect plant communities on the islands and may lead to erosion of shoreline and offshore islands.

Bird activity can be greatly reduced at roost sites by removing all the trees or selectively thinning the stand. Roosts often will re-form at traditional sites, and substantial habitat alteration is sometimes the only way to permanently stop such activity at a site (USDA 1997).

Supplemental feeding may be used as a method of drawing predators such as coyote or fox away from a nesting area. This practice involves providing a high quality food source such as a road killed deer or dead livestock near a nesting area so that predators have an easy to locate food source in place of nesting colonial birds. Situating supplemental feed can be difficult; if the food source is placed to far away from the nesting area it may not attract nest predators away from the nesting area. If it is placed to closely, it may actually draw new nest predators to the colony. Because of this, supplemental feeding is not generally recommended as a primary means of reducing nest predation but may be used in combination with other techniques.

MECHANICAL MANAGEMENT METHODS – NONLETHAL

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 but usually for only a short time before birds and mammals become accustomed and learn to ignore them (Schmidt and Johnson 1984, Bomford 1990, Rossbach 1975, Graves and Andelt 1987, Mott 1985, Shirota and Masake 1983, Conover 1982, Arhart 1972, Pfeifer and Goos 1982). Some but not all methods that are included by this category are:

- Propane exploders
- Pyrotechnics
- Distress calls and sound producing devices
- Repellents
- Scare crows
- Mylar tape
- Eye-spot balloons
- Lasers
- Effigies (taxidermic mounts and carcasses)
- Shooting to harass
- Chase with ATV's or vehicles

Predator-resistant fences are woven wire or smooth wire electric fences. Woven wire fences generally are four-foot tall and may have a barb 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. Also, dry soil conditions prevent grounding, and thus the animal can pass through the fence without being shocked (McKillop and Sibly 1988). Finally, salt water and salt spray corrode and eventually disable electric fencing. Electric fences also make the use of snares very difficult because of the reduced ability to detect where coyotes, red fox, raccoons, and opossums are passing through the fence. 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. Fences cost $4,500 to enclose a 16.2 hectare area in 1985.

Nest enclosures are electric or woven wire fencing placed around a nest to deter avian and mammalian predators. Nest enclosures 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). However, nest enclosures only reduce predation on enclosed nests versus unprotected nests, they do not stop nest predation (Sargeant et al. 1974, Greenwood et al. 1990, LaGrange et al. 1995). Harassment of incubating adults by coyote, fox, raccoons, skunk, and opossum can result in nest abandonment or predation. Chicks that hatch are still vulnerable to avian and mammalian predation once they leave the enclosure to feed.

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. 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, scare crows, 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 of time before birds become accustomed and learn to ignore them (Arhart 1972, Rossbach 1975, Shirota and Masake 1983, Schmidt and Johnson 1984, Mott 1985, Bomford 1990, Booth 1994). Birds, too, quickly learn to ignore scaring devices if the birds' fear of the methods is not reinforced with other tactics.

Visual scaring techniques such as use of Mylar tape (highly reflective surface produces flashes of light that startles birds), eye-spot balloons (the large eyes supposedly give birds a visual cue that a large predator is present), flags, effigies, 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). Effigies can be dead gulls or taxidermy gulls (Avery et al. 2002, Tillman et al. 2002, Humphrey et al. 2010). Effigies are hung upside down as high as possible in trees or from specially constructed masts to disperse gulls (Tillman et al. 2002, Humphrey et al. 2010). 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 cormorant roosts (Glahn et al. 2000*b*). 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*b*). During pen trials with lasers, the cormorants were inconsistent in their response with some birds showing no response to the laser (Glahn et al. 2000*b*). The lack of overt response by cormorants to lasers is not clearly understood, but suggests laser light is not an highly aversive agent (Glahn et al. 2000*b*). Blackwell et al. (2002) tested lasers on several bird species and observed varied results among species. Lasers were ineffective at dispersing starlings and cowbirds (Blackwell et al. (2002)). Lasers were 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.

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.

Foot-hold traps can be utilized to live-capture a variety of mammals. Three advantages of the foot-hold 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.

Foot-hold 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 foot-hold traps also requires more time and labor than some methods, but they are indispensable in resolving many depredation problems.

Foot-hold traps are constantly being modified and tested to improve animal welfare of captured animals. The Best Management Practice (BMP) testing process and research has identified some foot-hold traps that have acceptable capture efficiency and low moderate-severe injury scores. This BMP process is ongoing and traps which meet BMP standards are being published as research is being completed. WS in Massachusetts would only use traps that are approved in the BMPs at the time of the project. Cable restraints, wire snares modified with stops to live capture mammals by encircling either the neck or leg are used similarly to foot-hold traps and there are designs that meet BMP standards. Both foot-hold traps and cable restraints are banned for use in Massachusetts. As a result, foothold traps and cable restraints would only be utilized on federal lands.

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. Specialized raccoon traps would only be utilized on federal lands.

Cage or box traps, typically constructed of wire mesh or plastic, are sometimes used or recommended to capture raccoons, skunks, and opossums. 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 coyote and fox. Active traps are monitored daily to remove and euthanize or release trapped mammals and to replenish bait.

Rocket, cannon, pneumatic, tub launched nets, and net guns are used by WS for preventative and corrective damage management. Rocket and cannon nets are projectile-type net traps comprised of 3 - 5 rockets or cannons and a large net (e.g., 33 x 57 foot with 2-inch square nylon mesh) (Dill and Thornberry 1950, Cox and Afton 1994). The net is folded upon itself or set inside a net box. The rear of the net is anchored to 5 or 10 pound boat anchors or tied with inner tubes to stakes driven into the ground. The net is folded up upon itself. Bait is placed approximately 15 feet in front of the net. The rockets or projectiles in the cannons are propelled by smokeless powder or black powder charges which are ignited with an electric squib inside the charge. The charges are placed inside the rockets or cannon tubes and tested with a galvanometer for electrical continuity. A spool of at least 200 - 350 feet of 18 or larger gauge wire is unspooled and connected at one end to the charges and at the other end to a blasting machine. When an adequate number of birds are in front of the net, usually less than 25 feet away, the blasting machine is charged and fired. Firing the blasting machine sends an electrical charge down the wire and ignites the charges in the rockets or cannon tubes which discharge the net from the folded position. Birds are caught alive with rare instance of a bird being killed or injured. Captured birds may be humanely euthanized or released. Pneumatic cannon nets and tub-launched nets deploy under similar methodology as the cannon or rocket nets but do not use smokeless powder or black powder charges to deploy the net. The pneumatic cannon utilizes compressed air and the tub-launched net utilizes a .308 rifle blank to deploy the net. An air compressor is used to fill a reserve tank up to 220psi for the pneumatic air cannon. The pneumatic air cannon and tub-launched net are remotely detonated by hardwire, push button controls. WS personnel receive training before using rocket or cannon nets. Net guns are as expected, fired from a handheld position. These devices are similar to the tub-launched nets in that they use a .308 caliber rifle blank. The net is placed in a holding container attached to the front of the gun and has 4 weights attached to it. The net gun can be shouldered or fired from the hip which is best determined by the user. When fired, the weights are sent in 4 directions, expanding and carrying the net over and around the target being captured. WS uses this device regularly for the capture of birds and it is only a rare instance in which a bird is killed or injured by the net and/or weights.

MECHANICAL MANAGEMENT METHODS – LETHAL

Shooting is more effective as a dispersal technique than as a way to reduce bird densities when a large number of birds are present. Normally shooting is conducted with shotguns or rifles. It may be conducted with suppressed rifles (i.e. .22 caliber, .17 HMR, air rifles) rifles. Shooting is a very individual specific method and is normally used to remove a single offending bird. However, at times, a few birds could be shot from a flock to make the remainder of the birds more wary and to help reinforce nonlethal methods. Removal of a few crows 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 (USDA 1997). 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 PM activities and all laws and regulations governing the lawful use of firearms are strictly complied with.

Coyote, red fox, gray fox, raccoons, skunk and opossums are nocturnal animals. They may be illuminated at night with spotlights or found with thermal imaging equipment, and then shot with rifles or shotguns as they move about the islands or adjacent coastal areas. Raccoons may be shot Raccoons may be shot or captured with nets or catch poles while exiting denning sites in the evening. Coyote and fox may be called with predator calls imitating injuring 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 Amendment which prohibits firearm possession by anyone who has been convicted of a misdemeanor crime of domestic violence.

Denning is the practice of finding coyote and fox dens and eliminating the young, adults, or both to stop an ongoing predation problem or prevent future depredation. Till and Knowlton (1983) documented denning's cost-effectiveness and high degree of efficacy in resolving predation problems due to coyotes killing lambs in the spring. Coyote and 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 or kits. Pups or kits are typically live trapped and humanely euthanized by shooting, immobilization and euthanization drugs or with carbon dioxide gas. Pups or kits may also be turned over to a licensed wildlife rehabilitator in certain situations. Coyote and red fox dens are regularly found adjacent to shorelines in Massachusetts often adjacent to or even in nesting areas.

Sport hunting and regulated trapping can be part of a PM strategy to reduce local coyote, red fox, gray fox, raccoon, skunk, opossum, and crow from the shoreline and coastal islands. 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. Coyote, fox, raccoon, skunk, and opossum are classified as furbearer species in Massachusetts and may be hunted and trapped. Coyote may be hunted 1 January1 through March 8, and October 16 through March 8, 2011. Red fox and gray fox may be hunted January 1 through February 27, and November 1 through February 28, 2011. Raccoons and opossums may be hunted January 1 through January 30, and October 1 through January 31, 2011. Skunks can be taken year round except during the shotgun deer hunting season (November 29 through December 11) by licensed hunters with no daily or seasonal bag limit. Crows may be hunted January 1 through April 10

and July 1 through April 9, 2011. Crows may only be hunted on Friday, Saturday, and Monday during the open season. See MassWildlife hunting regulations for further details regarding firearm use, bag limits, and other information.

Coyote and fox may be trapped during the regulated trappings season from November 1 through November 30 by use of box traps only. Raccoon, skunk, and opossum may be trapped during the regulated trappings season from November 1 through February 28, 2011 by use of box traps. There are some exceptions to license requirements for landowners. The MassWildlife has specific regulations on license requirements which can be found in the MassWildlife hunting regulations.

Cervical dislocation is sometimes used to euthanize birds which are captured in live traps or nets. 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).

Body-grip (e.g., Conibear-type) and Snap Traps are designed to cause the quick death of the animal that activates the trap. The size 220 and 110 conibear traps are generally used for small to medium mammals. Placement is in travel ways or at burrow entrances created or used by the target species. The animal captured as it travels through the trap and activates the triggering mechanism. Safety hazards and risks to humans are usually related to setting, placing, checking, or removing the traps. Body-grip traps present a minor risk to non-target animals when placed in aquatic habitats and below the water surface or in terrestrial sets in trees 6 feet above the ground. Use of conibear traps, for species other than muskrat and beaver or in terrestrial sets, are currently banned in Massachusetts and would only be used on federal lands at the request of the resource manager. Large Snap Traps are legal in Massachusetts and may be used to take Norway rats and small Mustelids such as long-tailed and short-tailed weasels.

CHEMICAL MANAGEMENT METHODS

All chemicals used by WS to protect native bird species, including threatened and endangered wildlife or wildlife species of special concern are registered under the FIFRA and administered by the EPA and the MDAR. All WS personnel in Massachusetts that use pesticides are certified as restricted-use pesticide applicators by the MDAR; the MDAR requires pesticide applicators to adhere to all certification requirements set forth in the FIFRA. Only WS employees can use DRC-1339 and, if it were to become registered, mesurol in Massachusetts. No chemicals are used on public or private lands without authorization from the land management agency or property owner or manager. The chemical methods used, available and/or available if registered for use in Massachusetts are: DRC-1339 COR, Avitrol, zinc phosphide, anti-coagualant rodenticides, euthanasia drugs, and mesurol.

CHEMICAL MANAGEMENT METHODS – NONLETHAL

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

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

Measurol may be used only by WS personnel. Treated areas may be posted with warning signs at access points to exclude people from endangered or threatened species nesting areas if thought to be necessary. 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.

FDA registered chemical immobilization drugs may be used to reduce stress to live captured mammalian and avian nest predators. This may be done for individuals that are ultimately going to be euthanized or for individuals that are to be released onsite, relocated or turned over to a licensed wildlife rehabilitator for any reason. Immobilization drugs would only be used by WS personnel with appropriate training and licensing.

CHEMICAL MANAGEMENT METHODS - LETHAL

CO^2 is sometimes used to euthanize birds which are captured in live traps and nets. Live birds are placed in a container such as a plastic 5-gallon bucket or chamber and closed loosely with a lid. 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 also the gas released by dry ice. The use of CO^2 by WS for euthanasia purposes is exceedingly minor and inconsequential to the amounts used for other purposes by society.

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 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 1991).

Avitrol is acutely toxic to avian and mammalian species, however, blackbirds are more sensitive to the chemical and there is little evidence of chronic toxicity. Laboratory studies with predator and scavenger species have shown minimal potential for secondary poisoning, and during field use only magpies and

crows appear to have been affected (Schafer 1991). However, a laboratory study by Schafer et al. (1974) showed that magpies exposed to two to 3.2 times the published Lethal Dose (LD50) in contaminated prey for 20 days were not adversely affected and three American kestrels that were fed contaminated blackbirds for seven to 45 days were not adversely affected. Some hazards may occur to predatory species consuming unabsorbed chemical in the GI tract of affected or dead birds (Holler and Shafer 1982, Schafer 1981). A formal Risk Assessment found no probable risk is expected for pets and the public, based on low concentrations and low hazards quotient value for nontarget indicator species tested on this compound (USDA 1997).

DRC-1339 is the principal chemical method that would be used for crow 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 (Schafer 1981, Schafer 1991, Johnson et al. 1999). For example, starlings, a highly sensitive species, require a dose of only 0.3 mg/bird to cause death (Royall et al. 1967). Most bird species that are responsible for damage, including starlings, blackbirds, pigeons, crows, magpies, and ravens are highly sensitive to DRC-1339. Many other bird species such as raptors (Schafer 1981), sparrows, and eagles are classified as non-sensitive. Numerous studies show that DRC-1339 poses minimal risk of primary poisoning to nontarget and T&E species (USDA 1997). Secondary poisoning has not been observed with DRC-1339 treated baits, except crows eating gut contents of pigeons (Kreps 1974). During research studies, carcasses of birds which died from DRC-1339 were fed to raptors and scavenger mammals for 30 to 200 days with no symptoms of secondary poisoning observed (Cunningham et al. 1981). This can be attributed to relatively low toxicity to species that might scavenge on blackbirds and starlings killed by DRC-1339 and its tendency to be almost completely metabolized in the target birds which leaves little residue to be ingested by scavengers. Secondary hazards of DRC-1339 are almost nonexistent (Schafer 1984, Schafer 1991, Johnson et al. 1999). DRC-1339 acts in a humane manner producing a quiet and apparently painless death.

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

DRC 1339 has several EPA Registration Labels (56228-10, 56228-17, 56228-28, 56228-29, and 56228-30) depending on the application or species involved in the bird damage management project.

Massachusetts WS used or supervised the use of 1,193 grams (2.63 pounds) of DRC-1339 during the 5 year period from FY2006 to FY2010 (Table B-1).

Only WS personnel may use DRC-1339 in Massachusetts. Appedix H consists of the Label and Tech Notes for DRC-1339 COR.

Table B-1: DRC-1339 Used by Massachusetts WS from FY2006 to FY2010.

FY	EPA Reg.	Species	Total Take	Quantity Used (grams)
2006	56228-10	Starlings	7,000	226.25
2007	56228-10	Starlings Pigeons	14,000 120	442.26
2008	56228-10 56228-29	Starlings Crows	3,000 68	181.44 2.0
2009	56228-10 56228-29	Starlings Crows	4,000 3	90.72 2.6
2010	56228-10 56228-29	Starlings Crows	7,500 33	181.44 1.0

APPENDIX C
FEDERALLY LISTED THREATENED AND ENDANGERED SPECIES IN MASSACHUSETTS

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

Status	Species
E	Beetle, American burying (*Nicrophorus americanus*)
T	Plover, piping except Great Lakes watershed (*Charadrius melodus*)
E	Plymouth Red-Bellied Turtle (*Pseudemys rubriventris bangsi*)
E	Sea turtle, hawksbill (*Eretmochelys imbricata*)
E	Sea turtle, Kemp's ridley (*Lepidochelys kempii*)
E	Sea turtle, leatherback (*Dermochelys coriacea*)
T	Sea turtle, loggerhead (*Caretta caretta*)
E	Sturgeon, shortnose (*Acipenser brevirostrum*)
E	Tern, roseate northeast U.S. nesting pop. (*Sterna dougallii dougallii*)
T	Tiger beetle, northeastern beach (*Cicindela dorsalis dorsalis*)
T	Tiger beetle, Puritan (*Cicindela puritana*)
T	Turtle, bog (=Muhlenberg) northern (*Clemmys muhlenbergii*)
E	Wedgemussel, dwarf (*Alasmidonta heterodon*)
E	Whale, blue (*Balaenoptera musculus*)
E	Whale, finback (*Balaenoptera physalus*)
E	Whale, humpback (*Megaptera novaeangliae*)
E	Whale, right (*Balaena glacialis (incl. australis)*)
E	Whale, Sei (*Balaenoptera borealis*)

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

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

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

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

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

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

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

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

APPENDIX D
SPECIES THAT ARE STATE LISTED AS THREATENED, ENDANGERED, OR OF SPECIAL CONCERN IN THE COMMONWEALTH OF MASSACHUSETTS

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

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

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

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

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

PLANTS:

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

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

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

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

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

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

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

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

Viscaceae (Christmas-mistletoes)				
Dwarf Mistletoe	*Arceuthobium pusillum*	SC		

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