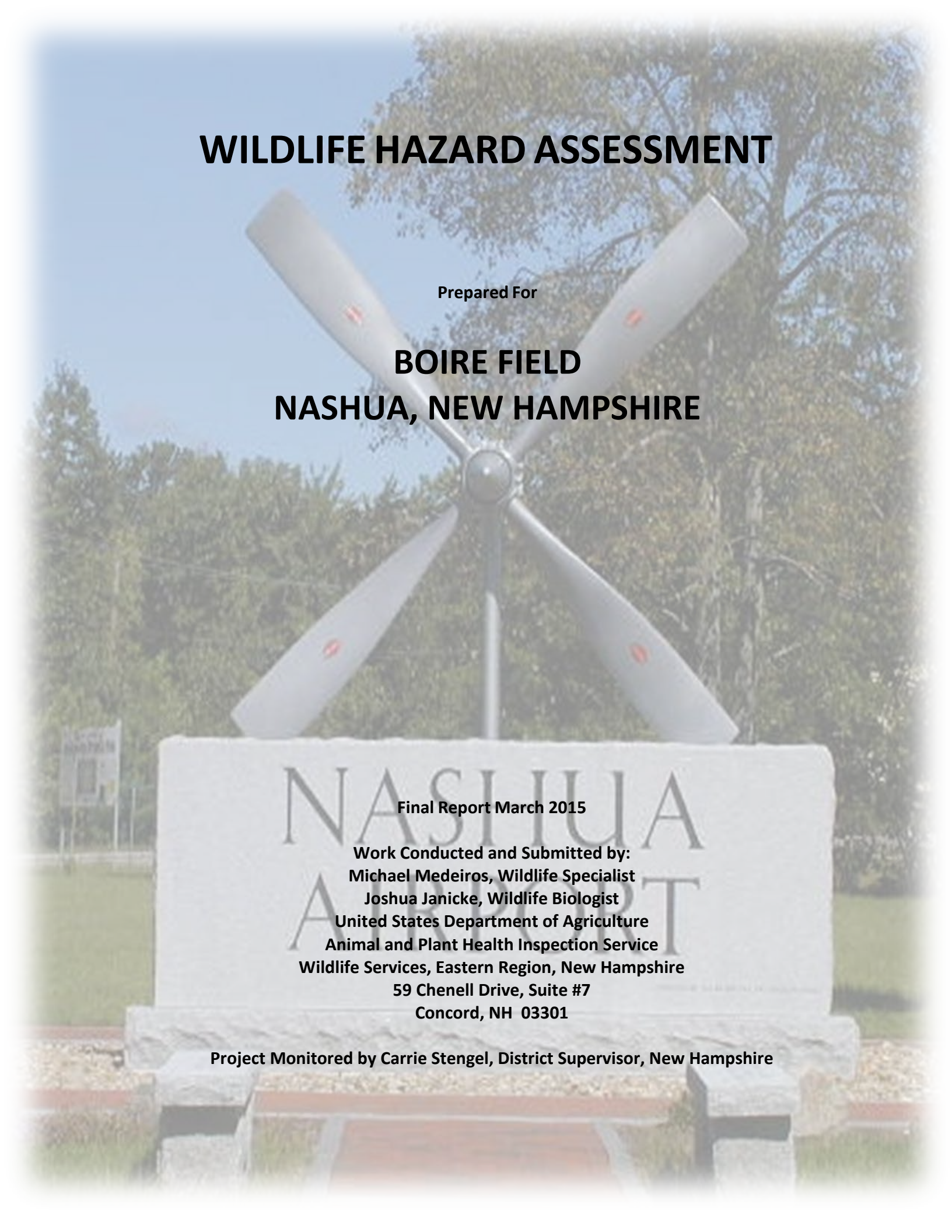


WILDLIFE HAZARD ASSESSMENT

Prepared For

BOIRE FIELD
NASHUA, NEW HAMPSHIRE

Final Report March 2015

Work Conducted and Submitted by:
Michael Medeiros, Wildlife Specialist
Joshua Janicke, Wildlife Biologist
United States Department of Agriculture
Animal and Plant Health Inspection Service
Wildlife Services, Eastern Region, New Hampshire
59 Chenell Drive, Suite #7
Concord, NH 03301

Project Monitored by Carrie Stengel, District Supervisor, New Hampshire

LIST OF ACRONYMS

AC	Advisory Circular
ADC	Animal Damage Control
AGL	Above ground Level
AOA	Airport Operations Area
APHIS	Animal and Plant Health Inspection Service
ATCT	Air Traffic Control Tower
BGEPA	Bald and Golden Eagle Protection Act
CFR	Code of Federal Regulations
DWC	Daniel Webster College
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FAR	Federal Aviation Regulation
FBO	Fixed Base Operator
FIFRA	Federal Insecticide Fungicide Rodenticide Act
FODD	Foreign Object Debris Damage
GA	General Aviation
GPS	Global Positioning System
ICAO	International Civil Aviation Organizations
IWDM	Integrated Wildlife Damage Management
IPM	Integrated Pest Management
LA	Lacey Act
MBTA	Migratory Bird Treaty Act
MOU	Memorandum of Understanding
KASH	Boire Field
NEPA	National Environmental Policy Act
NHFG	New Hampshire Fish and Game Department
NHDPC	New Hampshire Department of Pesticide Control
WCO	Wildlife Control Operator
NWSD	National Wildlife Strike Database
PAPI(s)	Precision Approach Path Indicator(s)
RPZ	Runway Protection Area
USDA	United States Department of Agriculture
USAF	United States Air Force
USFWS	United States Fish and Wildlife Service
WHA	Wildlife Hazard Assessment
WHMP	Wildlife Hazard Management Plan
WHWG	Wildlife Hazard Working Group
WS	Wildlife Services

EXECUTIVE SUMMARY

Wildlife strikes are not unique to Boire Field. Collisions between wildlife and aircraft are a concern throughout the world because they threaten passenger safety (Thorpe 1997), result in lost revenue and costly repairs to aircraft (Milsom and Horton 1990, Linnell et al.1996, Robinson 1997), and can erode public confidence in the air transport industry as a whole (Conover et al. 1995). Wildlife collisions with aircraft (wildlife strikes) have increased over the past two decades (Dolbeer et al. 2014). Reported wildlife strikes have increased 6.1 fold from 1990 to 2013 as a result of raised awareness regarding wildlife hazards within the aviation community (Dolbeer et al. 2014). However, although wildlife strike reporting has increased from 1990, damaging strikes have declined 20 percent from their peak of 764 reports in 2000 to 601 in 2013(Dolbeer et al. 2014). Recent awareness and implementation of professional wildlife hazard management programs are attributed to declines in damaging strikes.

Due to the increased awareness of wildlife inhabiting airports and the threat they pose to aviation operations, the Federal Aviation Administration (FAA) has implemented procedures to mitigate wildlife damages to aircraft and aviation operations. General aviation airports, such as Boire Field, are not required under Federal Aviation Regulations (FAR) Part 139 to conduct a WHA; however a formal assessment is beneficial to provide fundamental wildlife and habitat information for an effective, airport-specific, wildlife hazard mitigation program. This WHA was conducted under the Cooperative Service Agreement No. 13-7233-4983-RA at Boire Field from October 4, 2013 through September 30, 2014.

The objectives of this WHA were to identify wildlife species, abundance, locations, movements, and daily and seasonal activity trends. Additionally, this WHA identifies habitats on and near the airport that attract wildlife, documents existing wildlife hazards, reviews wildlife strike records and provides recommendations for mitigating wildlife hazards at Boire Field.

Several types of surveys were conducted to document wildlife occurrence at Boire Field including wildlife surveys, (on and off site), spotlight surveys and small mammal abundance surveys. Over the course of the WHA, 139 surveys were conducted resulting in 3,443 wildlife observations totaling 10,651 individuals among 120 wildlife species including 104 avian species, 14 terrestrial mammals and 2 reptile/amphibians. Brown–headed cowbirds, horned larks, European starlings, snow buntings, killdeer, American crows, Canada geese, mourning doves, white-tailed deer, striped skunks and coyotes were the most abundant wildlife observed during the WHA.

This WHA contains information and recommendations for species observed during the standardized wildlife surveys conducted between October 2013 through September 2014. Other species of wildlife not observed during the surveys may occur presently or in the future at Boire Field that require management activities. Contact WS or NHFG for management recommendations.

1.0 Introduction

1.1 Overview of Wildlife Hazards to Aviation

Wildlife collisions with aircraft (wildlife strikes) have increased over the past two decades (Dolbeer et al. 2014). From 1990 to 2013 the Federal Aviation Administration (FAA) received 142,603 wildlife strike reports in the U.S. with an estimated cost of more than $187 million to civil aviation annually (Dolbeer et al. 2014). Fourteen percent of wildlife strikes where the type of operator is known occurred with General Aviation aircraft (Dolbeer et al. 2014). Wildlife strikes threaten human health and safety (Thorpe 1997) and result in expensive repair costs and revenue loss (Milsom and Horton 1990, Linnell et al. 1996, Robinson 1997). Globally wildlife strikes have killed more than 255 people and destroyed over 243 aircraft since 1988 (Dolbeer et al. 2014). Escalating safety and financial concerns regarding wildlife strikes continues to be a growing issue to the global aviation industry.

Wild Turkeys at the glide slope shack during the WHA at Boire Field

Although wildlife strike reporting has increased from 1990, damaging strikes have declined 20 percent from their peak of 764 reports in 2000 to 601 in 2013. The decline in damaging strikes has been most pronounced for commercial aircraft while strikes have not declined for general aviation aircraft (Dolbeer et al. 2014).

The most recent recognizable bird strike occurred when US Airways flight 1549, later dubbed "The Miracle on the Hudson", struck and ingested Canada geese into both engines on January 15, 2009, resulting in an emergency landing on the Hudson River. Fortunately, the pilot was able to save the lives of those on board; however, the plane was a complete loss (Conover 2009). Wildlife strikes can also result in the tragic loss of human life. For example, in 1995, an Air Force E-3B AWACS aircraft collided with a flock of Canada geese at Elmendorf Air Force Base in Alaska killing all 24 passengers and crew (Gresh 1996, Ohashi et al. 1996). On March 4, 2008, a Cessna 500 struck an American white pelican in Oklahoma which caused the plane to crash resulting in five human fatalities (NTSB 2015). While wildlife strikes resulting in human fatalities are rare, wildlife collisions resulting in repairs, flight delays, and cancellations occur more frequently. Due to the increased awareness of wildlife inhabiting airports and the threat they pose to aviation operations, the FAA has implemented procedures to mitigate wildlife damages to aircraft and aviation operations. Federal Aviation Regulations (FAR) and policies are enacted and enforced by the FAA to increase and continually advance public safety.

Certificated airports are required by the FAA to conduct a WHA or ecological study when any of the following events occur on or near an airport:

(1) An air carrier aircraft experiences multiple wildlife strikes;
(2) An air carrier aircraft experiences substantial damage from striking wildlife. As used in this paragraph, substantial damage means damage or structural failure incurred by an aircraft that adversely affects the structural strength, performance, or flight characteristics of the aircraft and that would normally require major repair or replacement of the affected component;
(3) An air carrier aircraft experiences an engine ingestion of wildlife; or
(4) Wildlife of a size, or in numbers, capable of causing an event described in paragraphs (1), (2), or (3) of this section is observed to have access to any airport flight pattern or aircraft movement area.

Boire field is not a Part 139 airport and therefore is not required to comply with CFR Part 139.337 regulations. At the initiation of the WHA the FAA required GA airports receiving Federal funding to complete a WHA. During data collection the FAA reversed that requirement, however management at Boire Field elected to continue with the WHA to identify and mitigate wildlife hazards and develop proactive measures to reduce threats to human health and aviation safety as well as demonstrate due diligence.

The four scenarios listed above are not the only impact wildlife can have on aviation safety. Wildlife often has compounding effects on airport operations. For example, problems can arise from rodents chewing electrical cables for runway lights, parked vehicles and navigational aids. Burrowing mammals, such as woodchucks, can potentially cause structural damage to runways and/or buildings by undermining foundations and road beds. Fire hazards or damage can result from birds nesting in airfield structures, assorted aircraft or operations vehicles. Also, bird excrement can damage property and potentially effect human health. Wildlife hazards and resulting damages cause significant financial losses further increasing the effect of wildlife impacts on aviation operations.

Providing a safe airfield for air traffic operations is the responsibility of the airport manager. Airport wildlife hazards must be addressed in a timely manner. Negligence of potential wildlife hazards can hold the airport manager/director and administration liable (Dale 2009). It is important the airport exercise due diligence concerning wildlife hazards identified on the airfield and collaborate with adjacent property owners when wildlife hazards exist outside of airport property.

Various methods are available to reduce wildlife hazards and subsequently alleviate resulting damages. The methods chosen to decrease those hazards depend on the species involved and their attraction the airfield, habitat characteristics, spatial phenomena and temporal activity. It is necessary to have a comprehensive understanding of wildlife biology and the relationship wildlife has to specific environmental characteristics before initiating a wildlife control program. A WHA provides the foundation for site-specific understanding of potential wildlife hazards on and around airports. During an assessment, seasonal and daily fluctuations in wildlife abundance and behavior are recorded. Once

the data has been analyzed recommendations can be made to reduce wildlife hazards. Recommendations can also be made during the course of the assessment to manage existing wildlife hazards.

Once the wildlife hazard assessment is completed and recommendations are made, Boire Field may decide it is sensible to draft an informal Wildlife Hazard Management Plan (WHMP). The WHMP states the responsibilities, policies and procedures necessary to reduce wildlife hazards. The WHA provides the baseline data used to develop the WHMP. In some instances airports may contract with Wildlife Services (WS) to draft their WHMP.

1.2 Legal Authority of Wildlife Services

The United States Department of Agriculture (USDA) is directed by law to protect American agriculture and other resources from damage associated with wildlife. Animal and Plant Health Inspection Service (APHIS) WS has statutory authority under the Act of March 2, 1931 (46 Stat. 1468; 7 U.S.C426-426b) as amended, and the Act of December 22, 1987 (101Stat. 1329-331, 7 U.S.C. 426c), to cooperate with States, local jurisdictions, individuals, public and private agencies, organizations and institutions while conducting a program of wildlife services involving mammal and bird species that are reservoirs for zoonotic diseases, or animal species that are injurious and/or a nuisance to, among other things, agriculture, horticulture, forestry, animal husbandry, wildlife and human health and safety.

A Memorandum of Understanding (MOU) between FAA and USDA, Wildlife Services (formerly Animal Damage Control (ADC) exists that establishes a cooperative relationship between these two agencies to resolve hazards to aviation by wildlife (Appendix B). This MOU recognizes that WS has the professional and technical knowledge to reduce wildlife hazards on or near airports, and it acknowledges that most airports do not possess this expertise. A Memorandum of Understanding also exists between NASAO, FAA and WS that establishes the partnership and cooperation of these organizations to reduce the risk of wildlife hazards at airports (Appendix C).

WS Directive 2.305, *Wildlife Hazards to Aviation*, provides guidance for WS wildlife biologists in providing technical assistance or direct control to airport managers, state aviation agencies, the aviation industry, the FAA and the Department of Defense regarding hazards caused by wildlife to airport safety. Wildlife Services activities are conducted in cooperation with other federal, state and local agencies, and with private organizations and individuals.

The WS program is a non-regulatory, federal cooperative wildlife management program whose mission is to provide leadership in reducing conflicts between people and wildlife. WS has the primary responsibility for responding to threats caused by migratory birds. A growing focus of WS is to help promote the safe operation of aircraft by working with airport management to document, assess and manage wildlife hazards at airports throughout the country.

2.0 Objectives

The objectives of this WHA were to:

1. Identify avian and mammalian species, numbers, locations, movements, activity, habitat use and daily and seasonal occurrences on and near Boire Field.
2. Identify local landscape attributes attractive to wildlife on and near Boire Field.
3. Describe wildlife hazards documented at Boire Field to airport operations.
4. Review available wildlife strike records to determine if any significant species or patterns exist in the records, and use this information for management recommendations.
5. Provide Boire Field with management recommendations for reducing and/or eliminating wildlife hazards.

3.0 Boire Field

3.1 Boire Field Background

Boire Field is located in south-central New Hampshire in Hillsborough County, 3 miles northwest from the central business district of Nashua, NH and approximately 13 miles southwest from Manchester (Figure 1). At 204 ft. above sea level, Boire Field is located in the Eastern New England Upland physiographic region, within the Merrimack Valley. The Nashua River lies 1 mile to the Southeast and the Merrimack River lies 2.5 miles to the east. Boire Field encompasses and manages approximately 375 acres within its perimeter fence. The airport maintains and operates one primary runway (14/32), which measures 6000' by 100'. In 2012 the airport rebuilt and moved Runway 14-32 to the northeast 300 feet. It was also extended by 500 feet to 6,000 feet to accommodate corporate jets.

Figure 1: Location of Boire Field in NH

3.2 Airport Operations and Facilities

Boire Field is a public general aviation, municipally owned airport which is supported with full-time airfield maintenance and airport operations. In 2013, aircraft movements averaged 157 per day: 54% local general aviation, 46% transient general aviation, <1% air taxi and <1% military (Source: http://www.gcr1.com/5010web/airport.cfm?Site=ASH&AptSecNum=2). Operations in and out of Boire Field include training, charter, corporate, military and recreational flight operations. In addition, Boire Field has two fixed base operators (Nashua Jet Aviation; Infinity Aviation), three charter services, five flight schools, five aircraft maintenance facilities, and a number of businesses. Additionally, Boire Field houses approximately 90 tie down spaces and 140 hangars ranging from small private to large corporate hangars accommodating 239 based aircraft. Civilian aircraft using the airport are single-engine piston powered aircraft, multiple-engine piston aircraft, jet engine aircraft, helicopters and gliders.

3.3 Description of Boire Field and Surrounding Habitat

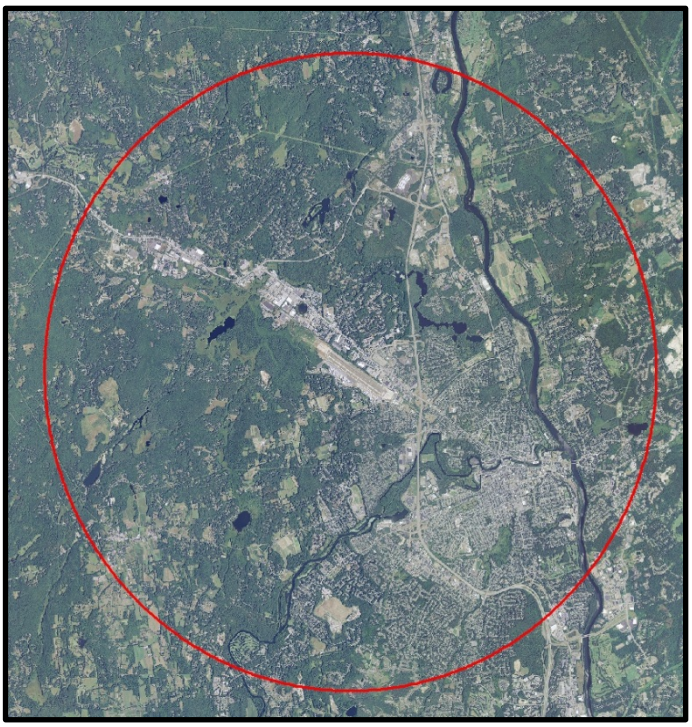


Figure 2: Habitat Features 5 miles around Boire Field.

Boire Field is surrounded by woodlands and wetlands, lakes and ponds, agriculture, residential areas and commercial retailers. During the WHA WS considered wildlife activity on Boire Field property and within a 5-mile radius of the airport (Figure 2). The Airport Operations Area (AOA) is enclosed within an 8 foot chain link security fence. The fence is equipped with 3 barbed wire outriggers around approximately three fourths of the airfield. The airfield is comprised of paved or concrete surfaces, permanent buildings, grassy areas, areas of brush and trees, woodlands, wetlands and drainage areas. Three ponds exist on the airfield that retain water year round and are surrounded by tall grass and brush. Three wooded areas are present inside the perimeter fence, sized at 32 acres, 17 acres and 4.5 acres. These areas consist of oaks, maples, birch and pine trees.

3.4 Wildlife Strike Analysis

In 1992, Bird Strike Committee Canada developed a bird strike definition that has been adopted by the FAA, International Civil Aviation Organizations (ICAO), Bird Strike Committee USA, Bird Strike Committee Europe, and the U.S. Air Force (USAF). As defined by FAA Advisory Circular (AC)150/5200-32B (http://www.faa.gov/documentLibrary/media/Advisory_Circular/150_5200_32b.pdf) a wildlife strike has occurred when:

A. A strike between wildlife and aircraft has been witnessed.
B. Evidence or damage from a strike has been identified on an aircraft.
C. Bird or other wildlife remains, whether in whole or in part, are found:

(1) Within 250 feet of a runway centerline or within 1,000 feet of a runway end unless another reason for the animal's death is identified or suspected.

(2) On a taxiway or anywhere else on or off the airport that you have reason to believe was the result of a strike with an aircraft. Examples might be:

(i) A bird found in pieces from a prop strike on a taxiway.

(ii) A carcass retrieved within 1 mile of an airport on the final approach or departure path after someone reported the bird falling out of the sky and a report of a probable wildlife strike.

D. The presence of birds or other wildlife on or off the airport had a significant negative effect on a flight (i.e., aborted takeoff, aborted landing, high-speed emergency stop, or the aircraft left pavement area to avoid collision with wildlife).

Wildlife strikes are largely uncontrolled events. It is impossible to predict exactly when an animal will or will not encounter an operating aircraft. This is because numerous dynamic environmental factors constantly affect an animal's behavior. A Wildlife Hazard Assessment (WHA) makes it possible to gauge a species' potential for a damaging collision with aircraft. This is done by considering factors such as the body mass of the animal, its frequency on the airfield, its behaviors while on the airfield, and its overall abundance in the local area. It is important to keep in mind that the following discussions of wildlife hazards focus on the *potential* for a damaging wildlife strike, but not necessarily the *probability* of such a strike. For the purposes of this WHA, a wildlife hazard is defined as: *A potential for a damaging aircraft collision with wildlife on or near an airport [14 CFR Part 139.337(a)(3)]*.

Wildlife strike data provides information to airports about wildlife hazards, including species struck, and daily and seasonal trends. From 1990 to 2013, 142,603 strikes were reported to the FAA (Dolbeer et al. 2014). For birds and mammals, waterfowl and carnivores are the most damaging species when struck (Table 1). Birds were involved in 97.0 percent of the reported strikes, terrestrial mammals in 2.2 percent, bats in 0.7 percent and reptiles in 0.1 percent (Dolbeer et al. 2014). The majority of bird strikes (52%) occur between July and October and 62% occurred during the day (Dolbeer et al. 2014). Mammal strikes were most abundant during summer and fall months and 64% occurred at night. From 1990 to 2013, 74% of bird strikes with GA aircraft occurred at or below 500 ft. above ground level (AGL), and 97% of bird strikes occurred at or below 3,500 AGL. Despite the invaluable information strike reports contain, it is estimated that nationally only 20% to 25% of all wildlife strikes are reported (Linnell et al. 1996, 1999).

Table 1. Documented wildlife strikes involving civilian aircraft in the United States from 1990 to 2013.

Guild	Nationally 1990 to 2013		
	No. of Strikes	No. of Damaging	Total Cost ($)
Birds	**138,257**	**12,457**	**596,737,860**
Waterfowl	4,418	1,849	216,768,401
Columbids	10,185	462	20,811,339
Icterids	7,868	251	9,556,446
Corvids	674	65	2,612,308
Passerines	14,313	236	4,808,625
Raptors	11,179	1,420	104,100,846
Gulls	9,656	1,373	53,464,710
Mammals	**2,307**	**917**	**39,673,496**
Ungulates	1,112	941	53,776,415
Carnivores	1,130	66	4,168,452
Bats	1,008	10	4,458,441

Wildlife strike reporting can provide a useful index for assessing the severity of wildlife hazards at a given airport and for monitoring the effectiveness of wildlife management actions. Determining the annual wildlife strike rates (the number of strikes per 100,000 aircraft movements) should be a priority for airport managers. Wildlife strike data based solely on pilot reports are generally unreliable and inconclusive because most pilots do not report strikes (Linnell et al. 1999). Strike reporting by pilots often varies due to factors such as; decreased pilot awareness of birds during critical phases of flight, animal size, flock size, weather conditions, time of day or heightened pilot awareness during migratory seasons (Linnell et al. 1999). By collecting the remains of wildlife found on runways during routine runway searches, airport managers can obtain information that would have otherwise been unavailable (Linnell et al. 1996), providing a more accurate assessment of actual wildlife strike events. Increasing populations of wildlife and numerous habitat attractants within Boire Field and its 5-mile separation zone suggest potential avian and terrestrial wildlife hazards. When the species of bird was identified, Canada geese were the species most involved in strikes reported to the FAA database at Boire Field since 1991 (Figure 3).

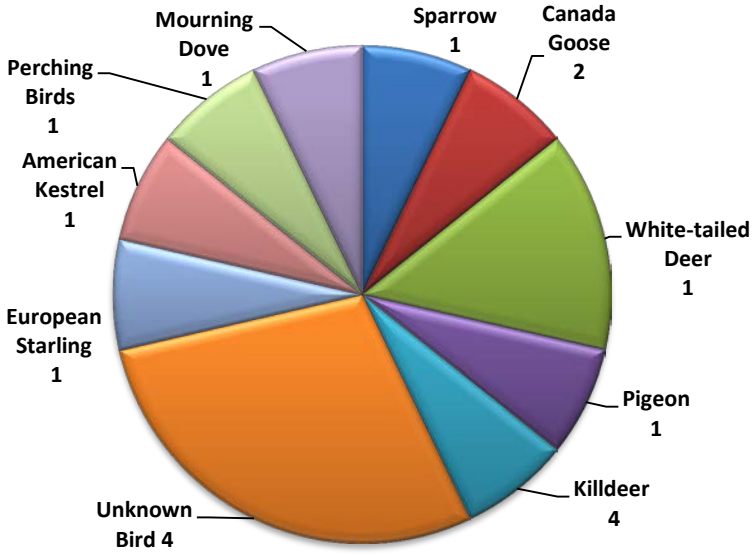


Figure 3: Reported Boire Field wildlife strikes in the FAA Wildlife Strike Database from January 1990 through November 2014.

A number of species including geese, wild turkeys, raptors, starlings, horned larks, snow buntings, cowbirds, herons, ducks, deer, foxes and coyotes are attracted to various habitats on and around the airfield. Periodically, some of these wildlife species congregate and gather into large flocks (ex. horned larks, European starlings and snow buntings) resulting in an increased threat to aviation safety. From January 1991 to October 2014, the FAA Wildlife Strike Database contains 14 wildlife strike records for Boire Field. From 1991 to 2008 an average of 0.5 strikes where reported per year. Since 2013 the number of reported strikes has increased to 3 per year. This noticeable increase is attributed to a change in management philosophy emphasizing the importance of reporting wildlife strikes (Table 2).

Table 2. Wildlife strikes at Boire Field reported to the FAA Wildlife Strike Database.

Date	Active Runway	Aircraft Type	Species	Cost of Repairs/ Aircraft Out of Service	Remarks
9/24/91	32	C-560	Rock Pigeon	Unreported	1" X 2.5" Dent in LE of L wing 3" from tip.
9/2/93	32	PA-28	Canada Goose	$3,500/ 3 months	LE wing skin replaced. ATIS warned of birds near runway.
5/22/94	14	PA-28	White-tailed Deer	$5,500	Hit two deer on departure. Pilot aborted takeoff without incident. No injuries reported. Prop and engine torn down. No damage to case or crank. Wheel fairings replaced, Lower wing skin replaced. SPAR was ok. Antennas replaced on belly.
12/17/96	32	C-303	Unknown bird-medium size	Unreported	Aborted takeoff.
6/1/03	32	BE-76 Duchess	Unknown bird-small size	Unreported	No remarks.
9/12/04	32	C-182 Skylan	Canada Goose	$25,000/ 4 Months	Hit 6-8 Geese (Assume Canada) Damage to both wings. L wing was punctured. Dents everywhere. Due to amount of damage, a conference was set up with FSDO and pilot. Aircraft still out of service and will be until January. Waiting for wing parts. Pilot did not see birds. Was DAR.
10/31/07	32	PA-28	Unknown bird-medium size	Unreported	On departure from Boire Field Runway 32, reported a bird strike. Aircraft returned to land. Without incident.
10/17/08	32	PA-44 Seminole	Unknown bird-small size	None	During a VOR-A approach into Boire Field about 4 miles southwest of the Manchester VOR, my instructor and I hear a noise and suspected a bird strike. After a normal landing, we found a strike on the horizontal stabilizer on right side next to vertical tail. No damage.
1/11/13	32	BE-76 Duchess	Sparrow	Unreported	Number struck not reported.
7/11/13	14	DA-2000	Mourning Dove	Unreported	On approach struck 2-10 birds. No damage reported.
8/22/13	32	Unknown	American Kestrel	Unreported	Bird carcass found on runway on south end. No strike reported.
9/26/13	32	Citation X	Killdeer	None	ID by Smithsonian.
11/7/13	32	Citation X	Perching Birds	None	ID by Smithsonian. Snarge found on right flap after returning to base.
12/19/13	Unknown	Unknown	European Starling	Unknown	Starling carcass found on runway. No strike reported.

3.5 Wildlife Management at Boire Field

Boire Field is not required to have a WHMP; however Boire Field views wildlife management as a priority. Current wildlife management practices include:

- current NHFG issued Deer and Turkey Depredation Permit to remove nuisance animals from the airfield,
- non-lethal control: the use of vehicles and hand-held pyrotechnic devices as staffing and time allow,
- limited lethal control of birds and white-tailed deer by airport personnel and designees,
- wildlife-aircraft strike reporting,
- comprehensive tracking of wildlife sightings, movements and control measures in the wildlife log,
- limited removal of beavers and their dams for flood control

4.0 Legal Status of Wildlife at Boire Field

Federal, State, and local laws are enacted in order to protect most forms of wildlife and their associated habitats. Prior to any control measure occurring (lethal or non-lethal), observations should be conducted in order to identify any and all species that will be affected. Proper permits must be in place prior to conducting certain control activities. Boire Field is responsible for adhering to all current regulations regarding the species to be managed, control methods, and obtaining the appropriate permits to take and/or harass the species to be managed. All bird species observed on and around Boire Field property during the course of this assessment, with the exception of European starlings, feral pigeons (Rock doves) and house sparrows, are protected by either Federal or State regulations.

4.1 Federal Regulations

The Migratory Bird Treaty Act (MBTA), the Lacey Act (LA), the Endangered Species Act (ESA), and the Bald and Golden Eagle Protection Act (BGEPA) all regulate the control of specific species and their habitats. These are the basis of most wildlife regulations that have been issued in the CFR. Several agencies share the responsibility of implementing and enforcing such regulations. The United States Fish and Wildlife Service (USFWS) primarily enforce that of the MBTA as well as the ESA. Permits are issued from the USFWS regional office for control actions involving species covered under the MBTA and must be renewed annually as well as all actions conducted under this act being reported at the expiration of the permit. USFWS also issues annual permits to airports for the harassment of Bald and Golden eagles which also require that all actions taken under the authority of the permit be reported at the end of the permit period. It should be noted that the term "migratory", as referred to in the MBTA, does not necessarily mean that the species has to migrate. For example, American crows and blue jays are year-round residents in New Hampshire and are protected as a migratory species under this act. For a complete list of birds protected by the MBTA, please visit http://www.fws.gov/migratorybirds/intrnltr/mbta/.

Boire Field has never obtained a USFWS Migratory Bird Depredation Permit. These permits allow for the lethal take of listed bird species, as well as the destruction of specific active nests in order to reduce the chance of a serious threat to aviation at airports. Throughout the duration of this assessment, non-lethal techniques were utilized by airport personnel to mitigate migratory birds. It is recommended that Boire Field obtain a permit to allow for the limited take of migratory birds to enhance non-lethal control measures. After a permit has been issued, Boire Field must request a new permit at least thirty (30) days prior to the expiration of the current permit, which expires at the end of one calendar year from the date of issue. Depredation permits (50 CFR 21.41 Depredation Permits) require that activities conducted while acting under the authority of the permit are documented to include the type of action used, species and numbers involved and the status of the carcass of those species lethally taken and be reported to the USFWS.

4.2 State and Local Regulations

New Hampshire State law follows the Federal regulations for migratory bird species and further regulates actions concerning mammals and game birds (Title XVIII: Fish and Game) (Appendix E). A few additional restrictions are placed on several "Species of Special Concern in NH" during breeding seasons, namely turtles (Appendix F). The New Hampshire Fish and Game Department is responsible for issuing state depredation permits (permits that allow state managed birds and mammals to be taken to protect property, agriculture, and human health and safety). The NHFG publishes these regulations annually as the New Hampshire Fish and Games Administrative Rules. A copy of these regulations is available from NHFG upon request or at their website (www.wildlife.state.nh.us/Legislative/legislative.htm). The airport is currently operating under a state issued depredation permit from the NHFG that authorizes the killing of white-tailed deer and wild turkey when they are creating a hazard to aircraft (Appendix D). Table 3 lists permits required for depredation control per species.

Table 3. A reference list of birds and mammals commonly found in New Hampshire and the permits required for depredation control.

Category	Species	State Permit	Federal Permit
Resident game birds	Turkey, ruffed grouse, quail, pheasants, Hungarian/European partridge, chukar	YES	NO
Resident nongame birds	Starlings, house sparrows, pigeons	NO	NO
Migratory game birds[1]	Geese, ducks, snipe, woodcocks	NO	YES
Migratory nongame birds[1]	Raptors, doves, gulls, jays, songbirds, swifts, swallows, shorebirds, and wading birds	NO	YES
Depredation order birds[2]	Crows, red-winged blackbirds, Brewers blackbirds, brown-headed cowbirds, and grackles	NO	NO
Protected species in NH	Deer, bear, moose, red fox, gray fox, coyote, fisher, skunk, raccoon, weasel, mink, muskrat, cottontail rabbit, snowshoe hare, gray squirrel	YES[3]	NO

Unprotected species in NH[4]	Woodchucks, porcupines, red squirrels, opossums, chipmunks, flying squirrels, rats, voles and mice	NO	NO
Threatened & Endangered Species (lethal & nonlethal control)	See Appendix I	NO[5]	YES
Feral domestic mammals	Dogs, cats, livestock	Call local animal control	NO

[1] For a complete list of migratory birds visit: http://www.fws.gov/migratorybirds/RegulationsPolicies/mbta/MBTANDX.HTML

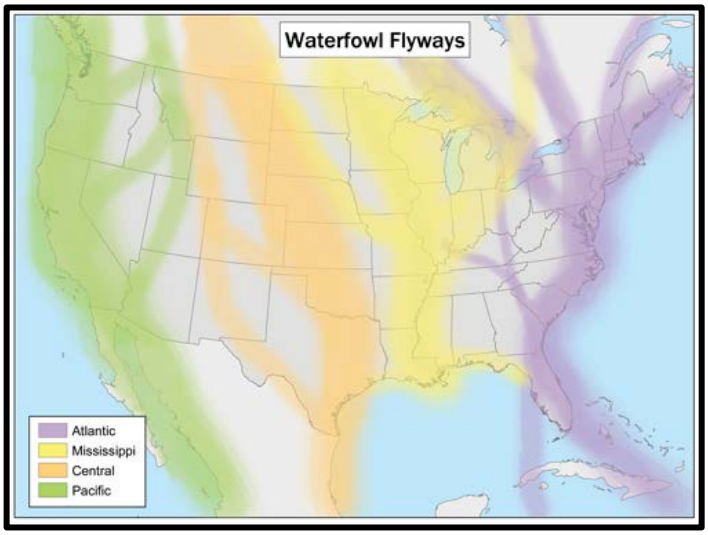
[2] A federal permit is not required "when concentrated in such numbers and manner as to constitute a health hazard or other nuisance," see 50 CFR § 21.43.

[3] Permit required for deer and turkey, all other furbearers taken will be included in annual report to state.

[4] Unprotected species may be taken at any time without limit.

[5] NH makes no specific provision for the taking of threatened or endangered species. NHFG will work with airports to address issues with T & E species should the need arise.

5.0 Boire Field Wildlife Attractants



Waterfowl flyways in the United States

Boire Field lies within the Atlantic Bird Migration Flyway of North America. The coastal route of the Atlantic Flyway generally follows the Atlantic shoreline and points east in New Hampshire, within Boire Field's airspace. The Atlantic Flyway is a regular and important route of travel for migratory waterfowl. Wildlife space use occurs at multiple spatial scales (Johnson 1980) and at the regional scale. Boire Field lies along a major geographic feature that provides a travel corridor for migrating birds. Within the landscape scale, Boire Field lies to the west of the City of Nashua and is surrounded by golf courses, bodies of water, recreational areas and human development. At Boire Field, the airfield itself serves as a wildlife attractant. Airports provide attractive habitat in the form of food, water and cover, as well as act as travel corridors for a number of species of birds and mammals. Retention and detention ponds attract numerous species of waterfowl, including ducks and geese. Raptors use elevated perches including navigational aids, utility poles, trees and fences while hunting for small mammals on the airfield. Additionally, hangars, buildings, landscaping and riprap provide habitat for mice and voles, which are an important prey base for coyotes, foxes and raptors. Large expanses of pavement on movement and non-movement areas provide basking opportunities from solar radiating pavement and thermal up-drafts used by soaring raptors. During periods of high rainfall, temporary standing water attracts many bird species, particularly gulls and shorebirds that feed on earthworms exposed during rain events. Woodlands provide cover and bedding areas for white-tailed deer, roosting sites for wild turkeys, denning sites for foxes, coyotes and skunks, and sources of food such as acorns, sumac, catkins and beechnuts eaten by many species of wildlife.

5.1 Habitats

Habitat is the environment in which a species or group of species lives. Wildlife requires three important habitat elements: food, water, and cover. Therefore, providing wildlife habitat within or adjacent to the airfield is considered hazardous. Removing these elements on an airport is the first defense against wildlife strikes. Even when these elements of wildlife management are carefully considered, events can occur which cause the attractiveness of the airport to increase for certain species. Seldom used areas may revert to brush and tall grass, soil may settle creating collection points for water and piled materials such as construction remnants, gravel or soil can serve as shelter for wildlife. Land adjacent to airports may become developed, dispersing wildlife causing them to seek habitats at an airport that meet their needs. For example, raised landing lights, trees and snags (standing, dead trees) may be used as a perch by raptors to search for small mammals. Habitats on Boire Field vary in size, distribution, vegetative composition and structural diversity. Currently, habitats found

on or near Boire Field can be categorized into grassland, woodlots, water and detention areas and disturbed areas including pavement, structures, navigational aids and unpaved areas. Each habitat type at Boire Field attracts wildlife species that could potentially be hazardous to aircraft. Whenever two or more habitats types meet up or intersect, an "edge effect" is created which often leads to greater diversity of wildlife species. Wildlife species affinity to edge habitats is a phenomenon in wildlife ecology. Usually, edges provide food and cover in close proximity to one another while promoting vegetative diversity because of the interfacing habitat types. The majority prime edge habitat at Boire Field exists along the wooded areas where trees and shrubs meet grass.

Identifying habitat types is a critical step toward implementing an effective habitat management program. Habitat management provides the most effective long-term solution for managing wildlife populations. Before implementing habitat modifications, careful consideration should be given to the cause and effect relationship regarding any actions conducted. In other words, modifying habitat attractiveness for one wildlife species may inadvertently increase attractiveness to another, potentially more hazardous species. Moreover, habitat modifications may displace wildlife resulting in the use of other habitats on or near the airfield. As such, it is important to identify all habitats on the airfield and determine how they are related to species' ecology. Accordingly, understanding the effects of habitat management actions beforehand is paramount when managing airfields to deter wildlife use.

Food sources for wildlife may include dumpsters, handouts from people, vegetation, nuts, seeds (including grass seeds), berries, insects, rabbits, rodents, frogs, fish and earthworms. Water sources can include streams, impoundments, puddles, sprinklers, dripping faucets, lakes, ponds and rivers. Cover and nesting habitat may include hangars for doves and pigeons; brushy or grassy areas in ditches, fields, and along fences; towers and signs; urban structures; trees; or abandoned machinery and materials. Fields at airports may also provide shelter for burrowing animals and feeding sites for insect eating birds.

Wildlife attractants promote varying levels of influence over species behavior (Cleary and Dolbeer 2005) and will dictate management actions directed toward a specific species. An attractant's impact is dependent upon the type of habitat being provided and whether the attractant offers food, water, cover, or a combination of the three. For example, nesting cover can increase the attractiveness of a habitat that would normally be considered unsuitable for wildlife (Cleary and Dolbeer 2005). The attractiveness of any habitat can be described by its ability to sustain wildlife activity with increasing levels of disturbance (e.g., noise, development, and inter/intra species competition). In general, food attractants often result in behavioral distractions subsequently increasing the risk of wildlife strikes (Cleary and Dolbeer 2005). The distance of the attractant from runway critical zones is also an important component in determining wildlife strike potential. When attractants are located on both sides of a runway or approach/departure lanes, bird movements between these areas are common and often result in an increase in wildlife strikes. Identifying wildlife attractants within and/or near airports is an essential component of a WHA. The following are wildlife attractants identified during the WHA that contribute to wildlife activity at Boire Field. Wildlife attractants identified or created in the future should be managed accordingly.

5.2 Habitat Components

Food

A variety of wildlife food sources exist at Boire Field. Natural food sources on the airfield offer a wide range of forage diversity including, but not limited to small mammals, insects, invertebrates, and vegetation such as seeds, fruits, buds and various grasses. Forage accessibility increases at times when insects, invertebrates and small mammals move onto paved surfaces. The ability of many bird species to forage for insects, seeds and small mammals in herbaceous openings is the primary factor contributing to the feeding preference for the grassland habitat by birds at Boire Field. Aquatic vegetation and organisms (insects, arthropods, amphibians, invertebrates, aquatic rodents and fish) found in ponds, detention basins, drainage ditches and woody wetlands provide wildlife attractants and natural food sources at Boire Field. Local ponds, lakes, standing water, small drainage basins and manmade structures serve as sources for aquatic organisms. Movements of birds over the airfield while utilizing these aquatic resources frequently occur at Boire Field due to its close proximity to a variety of hazards. Man-made food sources include artificial feeding via garbage receptacles. Artificial food sources outside of Boire Field may be provided by agricultural operations, food production facilities, intentional feeding at local recreational areas, the landfill and nearby restaurants. The following is a description of food sources, attractant locale, species attracted and seasonal availability.

Seeds, nuts, berries, and other fruits

All forms of vegetation produce a seed, fruit or nut and these high energy food items are essential foods for many forms of wildlife. The grassland habitat at Boire Field provides seed-bearing grasses, forbs and other plants that attract insects, birds, squirrels, woodchucks, mice, shrews and voles which in turn attract species that prey on them. These areas include the grass areas within the infield and around the movement areas within the perimeter fence. The major woodlands located on the northwest of the airfield along India Ramp north to the fenced portion of the airfield as well as the woodland located adjacent to the railroad track on the eastern side of the airfield provide feeding areas that are in close proximity to cover. Wildlife species that forage on these fruits and seeds include, but are not limited to, forest and grassland birds and small mammals (mice, shrews, voles, squirrels, skunks, and rabbits). Ornamental plants bearing nutritious fruits and nuts in the airport environment should be removed. Shrubs and trees like this can be found in the parking lot at Daniel Webster College (DWC) Aviation School and around the hangars and parking areas at Boire Field. Fruit and nut producing trees and shrubs can be found in most brushy and wooded areas at Boire Field or just off the airfield. These include mast producing trees such as oak and berry producers such as autumn olive, honeysuckle, raspberry/blackberries and blueberries. Even conifers such as white pine can produce cones or berries consumed by wildlife. USDA-WS can recommend ornamental plantings compatible with the airport environment.

Small mammals

Small mammals such as mice, voles and shrews attract predators including carnivorous mammals (i.e., coyotes and fox), raptors, owls and crows. They can be found in all heavily vegetated

areas at Boire Field, as well as around structures. Small mammals are present year-round but accessibility by predators is often reduced in winter, when snow is present. Larger mammals such as squirrels, rabbits, muskrats and woodchucks are also an attractant to predators including red-tailed hawks, great horned owls, coyotes and foxes. Boire Field provides habitats for all of these mammals. These medium size mammal species are present year round except for woodchucks and Eastern chipmunks, which usually spend most of the winter months hibernating underground. However, mild winter weather and a lack of snow cover can allow woodchucks and chipmunks to leave their burrows to feed even in January and February.

Birds

Songbirds, pigeons and waterfowl serve as prey for avian and terrestrial predators. Presence of these birds in the airport environment attract predators such as raccoons, snakes and coyotes. During the nesting season, bird eggs, chicks and fledglings are highly sought by predators. Birds are present year round at Boire Field; however, most mammal predation occurs during the spring, summer and fall when nests and inexperienced juveniles such as savanna sparrows and killdeer are most vulnerable.

Insects and Other Terrestrial invertebrates

Insects represent a diverse food source to many hazardous wildlife species, and they are found in all areas at Boire Field. Some habitats may harbor higher species diversity and abundance than others. Many songbirds are strict insectivores and feed in woodland habitat. Other birds such as American kestrels, red-winged blackbirds, grackles, starlings, swallows and killdeer feed on insects that exist in open habitats. Crows and gulls routinely forage on insects found in short grass habitats. Even some mammals such as raccoons and skunks rely on insects and insect larva, such as grubs, for a high percentage of their caloric intake during certain times of the year.

Besides insects, other terrestrial invertebrate species exist at Boire Field including arachnids, isopods (pill bugs) and earthworms that attract skunks, gulls, crows and robins. Earthworms are of greatest concern in this category. Worms are typically found in grass areas near the AOA, and attract species such as gulls and crows. Worms are more prevalent when the ground becomes saturated during heavy rains, especially in the spring and fall. Worms are indeed present at Boire Field, but were not identified in large numbers during the WHA. They are found in all terrestrial areas of the airport, but are the biggest problem in the grassy areas adjacent to all runways and taxiways. Terrestrial invertebrates are available year round to some extent, but are most abundant during the spring, summer and fall.

Aquatic invertebrates

Aquatic invertebrates including insects, snails, crustaceans and amphipods attract shorebirds, wading birds and dabbling ducks. Invertebrates are particularly important to juvenile waterfowl which rely on them for their high protein content, an important nutrient necessary for rapid growth. Aquatic invertebrates are found year round but vary in abundance depending on species and water temperature. Invertebrates can be found in any and all standing water within Boire Field boundaries. Aquatic insects such as mayflies, stoneflies, black flies, and mosquito larva hatch into flying insects that

hide out in long grass. In this life stage, flying insects serve as the primary food sources for aerial foragers (chimney swifts and swallows). Aquatic insects, are found in all fresh water sources and can be located in the water column as well as the substrate, which allows a variety of birds with different feeding strategies to access them.

Dumpster left opened, possible food attractant

Human refuse and artificial feeding

Unsecured or open garbage cans and dumpsters, litter and artificial feeding can attract many wildlife species. At Boire Field open dumpsters were observed which can attract gulls, European starlings, crows, pigeons, house sparrows, raccoons, opossums, skunks and Norway rats. During any future construction project all human refuse should be disposed of properly. Boire Field's close proximity to nearby restaurants, located along Route 101A (Amherst Street), increase the hazard potential because birds and mammals will cross the airfield to access the food waste at these sites. A couple of restaurants are known wildlife feeding sites.

Water

Fresh water sources including lakes, ponds, rivers, detention areas, wetlands and temporary standing water provide food and cover and are highly attractive to wildlife. Water sources at Boire Field were primarily attributed to three water retention ponds (pond 1, 2 and 3), three drainage swales and temporary standing water. All three of the retention ponds held water year round and during rain events pond 2 and 3 would become one large pond. In pond 3 beaver activity was noted beginning in October and continued throughout the duration of the WHA. In pond 1, muskrat were observed on several occasions. All three ponds are highly attractive to migrating ducks and geese as well as other shore birds, however most activity of these species was observed at pond 2. Canada geese successfully nested and fledged goslings at Pond 2. These ponds also provide habitat to frogs and other aquatic prey items.

Standing water during snow melt

After rain events standing water was observed on the ramp next to the tower, next to the access road to the 14 approach lights and in the safety area south of the glide slope shack. Also, during rain events standing water was observed in the

drainage swale paralleling runway 14/32 south of the 32 obstruction tower. Additionally, the woodlands west of India ramp and the woods running the length of the runway on the northeast side were seasonally flooded.

Cover

Cover includes areas that are used by wildlife for nesting, roosting (sleeping), loafing, and/or protection against predators and weather. The following is a description of the categories of cover at Boire Field, their location, the main wildlife species using them and for what activity.

Vegetation

Short grass

Grass exists throughout most of the airfield and is either frequently or infrequently mowed depending on time and personnel availability. Short grass is consistent throughout the infields, in between runways, taxiways and ramps and around the terminal and hangars. Crows, killdeer, European starlings, some songbirds, rabbits, red fox and coyotes were all attracted to short grass to feed on insects, worms and small mammals as well as to loaf.

High grass

Longer grass exists inside the fence around the three ponds particularly in the small field east of Pond 1. High grass was also found, at times, inside the fence north of the runway 14 approach lights and along the tree-line to the north east of runway 14-32, extending the length of the airfield. Additionally, both long grass and emergent shrubby vegetation were found outside the perimeter fence at the approach end of runway 14 across Deerwood Drive. Grass is mowed when time and personnel allow in these areas both inside and outside the perimeter fence. These areas were frequented by deer, turkeys, rabbits, red foxes and coyotes. The areas where high grass meets the hardwoods, ponds, short grass etc. create edge habitat which are good places for predators to stalk for small mammals. The high grass acts as cover and a loafing area for many avian and mammalian species. Deer for instance, like to use the high grass for concealment. A number of songbirds and crows were regularly seen in these areas. Infrequently mowed areas can quickly become overgrown with small shrubs and trees, which provide cover for small mammals, den sites for coyotes, foxes and woodchucks.

Scrub/Shrub

At Boire Field, scrub and shrub vegetation exist mainly near edge habitat, around buildings and hangars or in areas where long grass has grown up and started to convert to shrub habitat. Many shrubs, particularly ornamentals, produce fruits and seeds which serve as attractants to some mammal species like chipmunks and other rodent and avian species such as house sparrows and mocking birds. These shrubby areas also provide a source of cover for small mammals and song birds that attract predators like hawks.

Trees

There are many wooded areas on Boire Field and trees are used by numerous wildlife species every day for food, cover, nesting and hunting perches. On the west side of the airfield, behind the Airfield Maintenance Building, there is a stand of mixed deciduous trees in which small song birds roost and feed. The East side of the airfield near the 34 glideslope contains a large stand of mixed timber, which supports cover habitat for white-tail deer, coyote and red fox. Major woodlands include the section of trees and shrubs located in the area between India ramp and Deerwood Drive; both deer and turkeys were seen utilizing this area. A large stand of trees and associated vegetation runs along the perimeter fence between Charron Ave heading northwest to Deerwood Drive. The India ramp woodlands and the Charron Ave to Deerwood Drive woodlands both experience seasonal flooding. Song birds use many of the trees at Boire Field as nesting and roosting sites. Some of the species of trees on the airfield produce mast or fruit (acorns, cherries, etc.); these trees will be used by different avian and mammalian species for food throughout the year. These areas provide both food and cover for a variety of species of birds and mammals, primarily white-tailed deer. Mast and seed producing trees should be removed from all airfield environments.

Airport structures, facilities and navigational aids

Airport facilities and structures include the terminal and maintenance buildings, hangars, FAA towers, businesses and any other buildings around the airfield which provide shelter for wildlife. Navigational aids, lights, signs, towers, radar units and radio antennae are another form of cover on the airfield. Birds, especially American kestrels, were commonly observed perching on various antennas, signs, lights, windsocks, markers, posts and fencing all over the airfield. Raptors, crows and numerous other birds were occasionally observed perching on lights and signs. Woodchucks were observed crawling under the perimeter fence, running under the storage container at the south end of the airfield by the 32 run-up area and burrowing near the approach of runway 32. European starlings and English house sparrows commonly perch on most hangers and large buildings in the vicinity of the airfield. Mourning doves, European starlings, American robins and other small birds frequently perch on light posts and the fence line throughout the airfield.

Wetlands

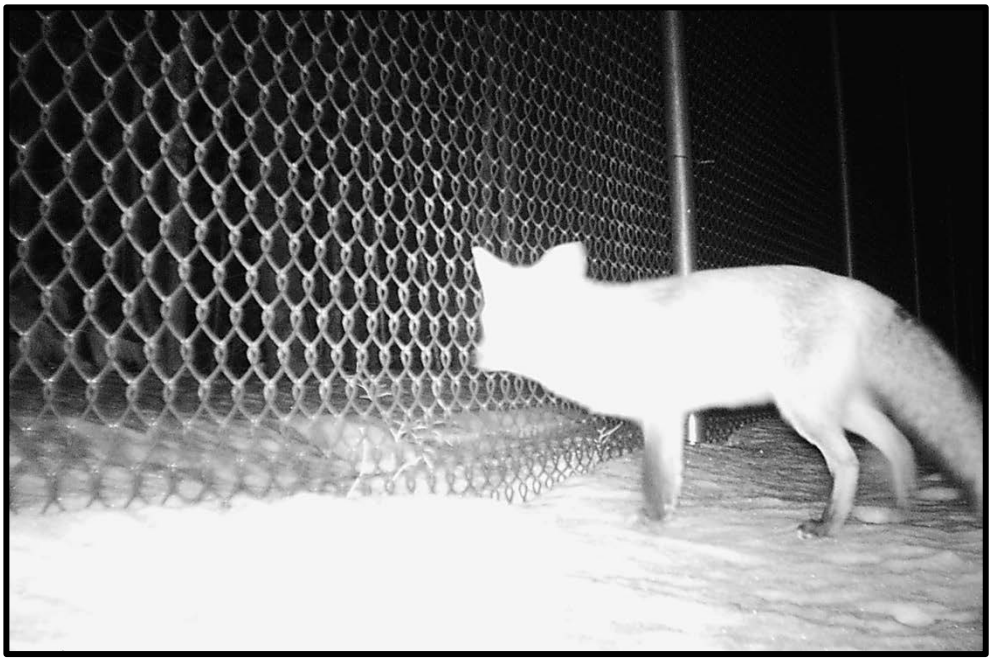
Wetlands are an important form of cover for a wide diversity of wildlife. Many hazardous birds and mammals are associated with wetlands. While many wetlands contain aquatic vegetation for cover, even open water can provide escape cover for some species. On-site at the airport, great blue herons, ducks, and various songbirds were observed at wetland areas.

Photo credit: Stephen Bourque/Boire Field

Snowy owl on navigational aid

Pavement

Paved surfaces are located throughout the airfield and include all ramps, taxiways, runways, roads, and vehicular parking lots. While paved areas do not provide much cover, they are often used by blackbirds, crows, gulls and killdeer for loafing and feeding, and WS did observe this at Boire Field. Seasonally, paved areas offer foraging opportunities for insects or earthworms.



Fox inside perimeter fence at Boire Field

6.0 Perimeter Fence at Boire Field

6.1 Perimeter Fence Survey

During the course of the WHA at Boire Field a complete inspection of the perimeter fence was performed by WS personnel and areas of deficiency, holes or gaps and points of animal ingress were mapped (Figure 4). Accessible areas of the perimeter fence were also spot checked during wildlife surveys. All identified wildlife points of entry were reported to maintenance personnel.

Tracks under the fence at Boire Field

The fence at Boire Field consists of 8 foot chain link with barbed wire outriggers around a majority of the airfield. The portion of fence parallel to Pine Hill Road and Perimeter Road to Gate H is constructed of 4 foot chain link with numerous gaps. Devault et al. 2008 found that deer will readily pass under an opening 25 cm (approximately 11 inches) high and when sufficiently motivated will pass through an opening 19 cm (approximately 7 ½ inches) high under a fence. Fencing height is also an important factor to consider, as motivated deer can clear a 2.4 (approximately 8 feet) meter fence (Sauer 1984). Fencing of a height of 3 m (approximately 10 feet) may be the most effective regime in airport environments where complete exclusion is desired (VerCauteren et al. 2006). FAA Certalert No. 04-16 "Deer Hazard to Aircraft and Deer Fencing" (Appendix G) recommends a 10-12 foot chain link fence with 3-strand barbed wire outriggers.

In some cases an airport may be able to use an 8-foot chain link fence with 3-strand barbed outriggers, depending upon the amount of deer activity in a local area. Certalert No. 04-16 goes on to state that a 4-foot skirt of chain-link fence material, attached to the bottom of the fence and buried at a 45^{o} angle on the outside of the fence will prevent animals from digging under the fence and reduce the chance of washouts. This type of fencing also greatly increases airport security and safety.

The areas surrounding the fence at Boire Field where mowers could access were mowed when personnel were available. During the WHA maintenance personnel were actively clearing brush, vines and small trees from the fence line along Deerwood Drive. At the end of the WHA, Boire Field had removed or was in the process of removing the section of 4 foot fence. From the corner of the DWC Aviation School to Charron Avenue the fence had been replaced with 8 foot chain link. The section of fence from the operations building to gate H had been taken down and a crew was in the process of erecting new 8 foot chain link fence. During the data collection portion of the WHA at Boire Field the

fence line to the East of Runway 32 could not be easily accessed, making it difficult to monitor for dig outs. During the writing of the WHA crews were in the process of clearing trees away from the section of fence line referenced above in preparation of removing and replacing that section of fence. Inspection of the area of fence that parallels Charron Ave revealed a few large gaps. Due to the deficiencies described above, the two most hazardous mammals to aviation safety, white-tailed deer and coyotes, were found readily accessing the AOA creating a strike risk. Recommendations to address the current fencing situation at Boire Field are included in the recommendations section of this document.

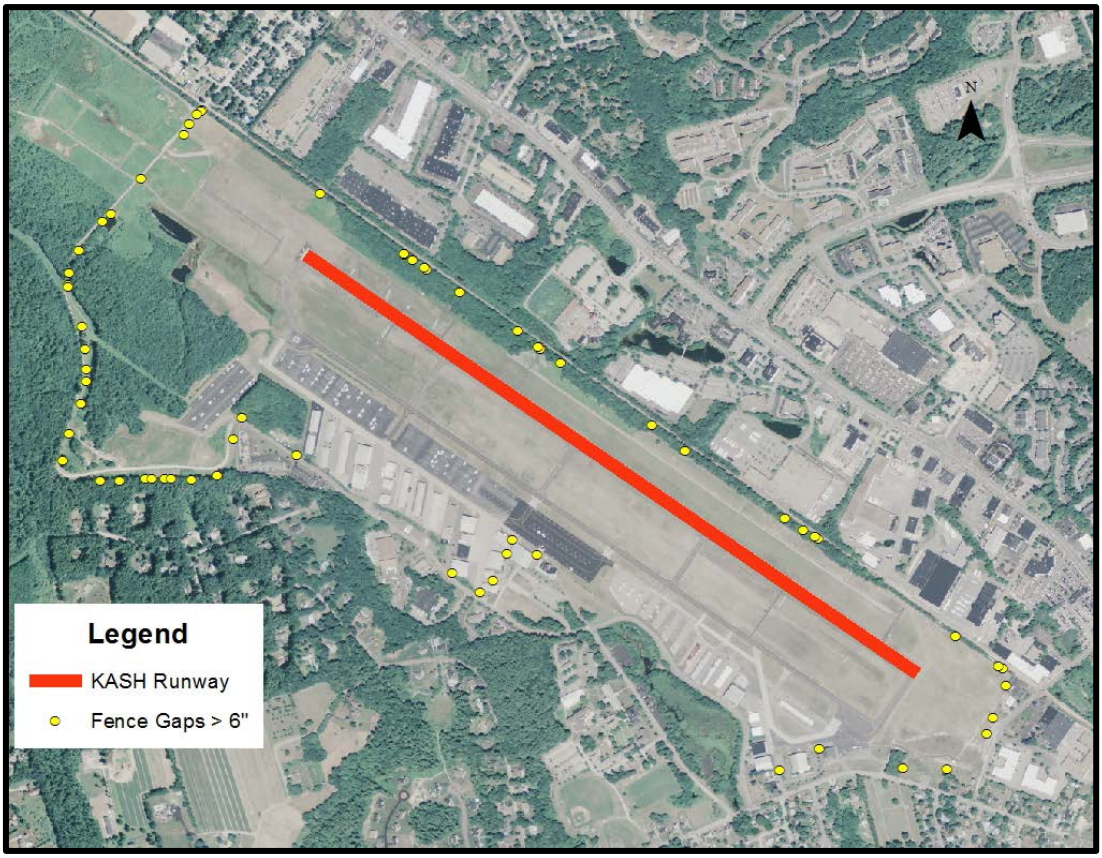


Figure 4. Perimeter Fence Survey indicating gaps greater than 6 inches.

7.0 Methods

7.1 Airfield Wildlife Surveys

Crepuscular (morning and evening) and diurnal (afternoon) surveys were conducted on a weekly basis for one calendar year (October 1, 2013 to September 30, 2014). Survey methodology, based on the standardized USFWS Breeding Bird Survey, consisted of observing wildlife activity for 3-minute intervals at each of the 13 designated survey stations to document wildlife species occurrence (Figure 5). Collectively, all survey points adequately covered the entire airfield, especially Boire Field's aircraft movement area. Surveys included two crepuscular dawn/morning, two crepuscular evening/dusk, two diurnal afternoons and two randomly selected survey times. Wildlife surveys consisted of recording spatial coordinates, date, time, species observed, number observed, habitat (Table 4) and wildlife activity or behavior (ex. flying, perching, feeding or vocalizing).

Data was collected using a Trimble® Juno 3B handheld global positioning unit along with ArcPad 10 Software (Environmental Systems Research Institute 2011). Field optics (binoculars) were used to identify wildlife species and count individual numbers. Smaller bird (e.g., sparrow spp.) sight ability decreased substantially at farther distances, thus small songbirds were only detected when observed at close range, in large flocks or through vocalizations. Therefore, the number of small, solitary birds may be underestimated. In addition to providing a report on the current use of the airport by birds, this assessment provides a baseline of information by which airport operations can evaluate the effectiveness of their wildlife management program in the future.

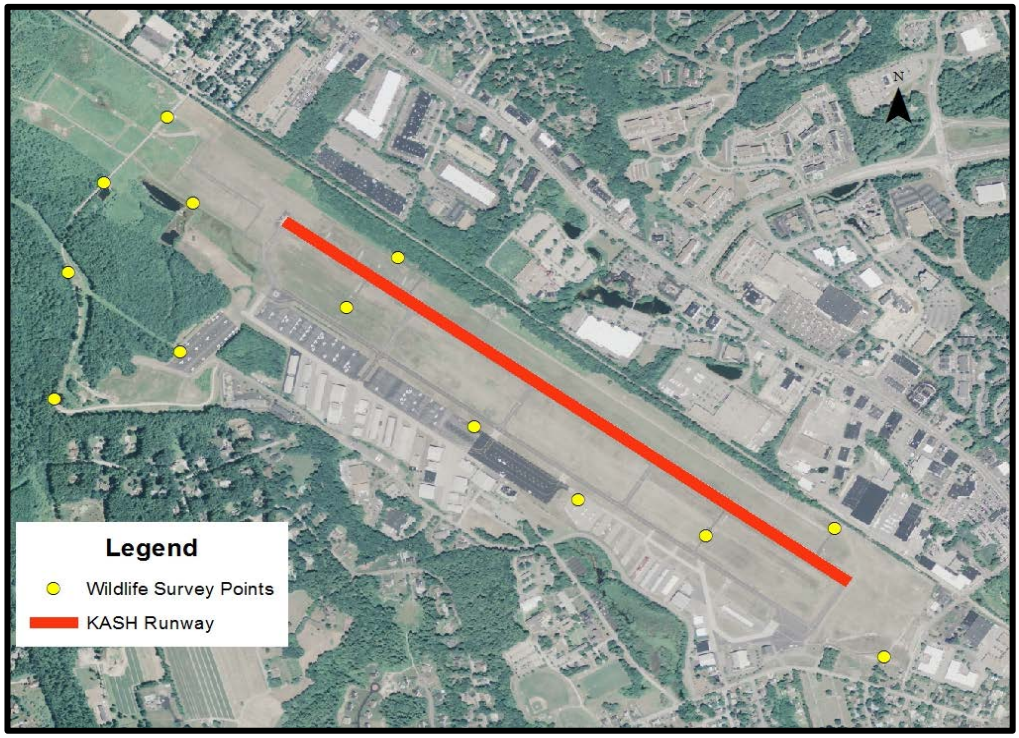


Figure 5. Wildlife survey points (n=13) used to conduct Boire Field's WHA from October 2013 through September 2014.

Table 4. Habitat classifications used for Boire Field's WHA from October 2013 through September 2014.

Habitat	Description
Asphalt/concrete	Areas other than ramps, runways, or taxiways
Agriculture	Areas containing crops and livestock
Creek/stream/river	Linear bodies of water
Ditch	Areas designated for water runoff and drainage into larger detention areas
Fence	Any fencing on the airfield
Frequently mowed	Areas mowed >1 time a year
Infrequently mowed	Areas mowed once a year
Rarely mowed	Areas that are never/rarely mowed
Long grass	Grass areas >12 in. in height
Short grass	Grass areas ≤12 in. in height
Marsh/wetland	Areas that hold water ≥48 hours and contain wetland vegetation
Pond/reservoir/lake	Permanent bodies of water
Detention basin	Areas designed to temporarily hold water while slowly draining to another location
Ramp	Permanent or temporary aircraft parking areas
Runway	Paved surface of the runway and the airspace above it
Taxiway	Paved surface of the taxiway and the airspace above it
Navigational aids	Any airfield structure and instrumentation utilized for aircraft movements (ex. signs, lights, glide slope, and wind sock)
Shore	Area of interface between water and land
Shrubs	Any woody vegetation <10 ft. in height
Structure	Any man-made object (ex. buildings and hangars)
Temporary standing water	Any area that temporarily holds water and contains little or no vegetation
Unpaved surface	Any area covered with gravel or dirt (ex. perimeter road)
Utility	Any utility infrastructure such as street lights, poles, wires, and transformers
Woodland	Any area containing woody vegetation over 10 ft. in height.

7.2 Small Mammal Surveys

A survey of small mammal abundance was conducted during the WHA. This survey allowed WS to monitor the presence and relative abundance of small mammals (i.e., mice, voles, shrews) that serve as a prey base and attractant for raptors and large mammals such as coyotes and foxes. The survey was conducted in the spring and fall, when small mammals are most active. The survey plots were selected in four locations based on runway location and habitat type (edge, woodland, short and long grass) (Figure 6). The plot locations included the east side of the south end of runway 14-32 along the tree line (Figure 6, edge), the northern end of Runway 14-32 west of the runway approach light area (Figure 6, long grass), in the woodland on the east side of runway 14-32 from the northern obstruction light tower running just south of the glide slope shack (Figure 6, woodland), and in the infield from between runway 14-32 and Alpha running from just north of the 32 run-up to just south of Bravo (Figure 6, short grass). These sites were chosen to assess prey abundance in edge, long grass, woodlands and short grass habitats. Two hundred (200) traps were set for three consecutive evenings in May and three consecutive evenings in September, for a possible total of 1,200 trap-nights. Mouse sized snap traps were used for each trap period. The traps were checked daily and all mammals caught were positively identified.

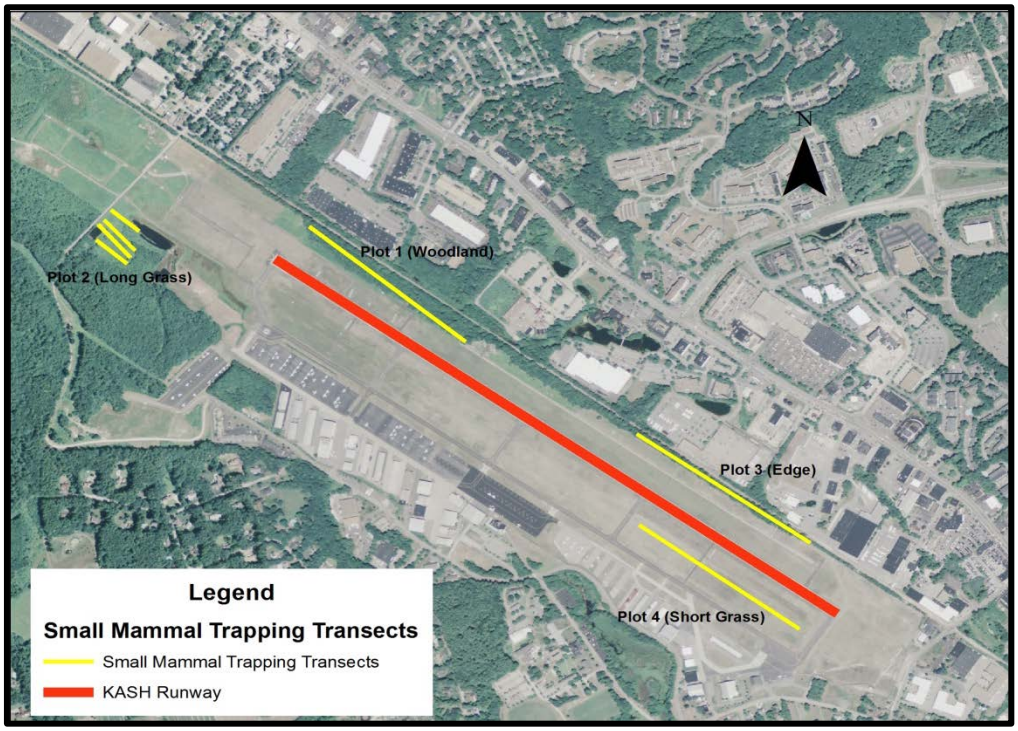


Figure 6. Locations of small mammal trapping transects used during WHA trapping surveys at Boire Field in May 2014 and September 2014.

7.3 Nocturnal Wildlife Surveys

Most large mammals and a few species of birds are nocturnal and are generally most active after sunset or before sunrise. Nocturnal surveys were conducted twice a month on the airfield starting one hour after sunset for a total of 24 surveys. Spotlights were used to observe mammalian activity and, to some degree, avian activity. Nocturnal surveys did not follow the same standardized point count method used during diurnal surveys when visibility isn't as issue. Instead, nocturnal surveys were conducted by slowly driving the perimeter road and movement areas of the airfield. Animals were viewed using a spotlight. Their activity, location, and number were recorded.

7.4 Incidental/General Observations

General observations followed no standardized protocols for the collection of data, and were collected at any time during the course of the WHA period. Because they did not follow a specific format, this procedure allowed for greater flexibility when making field observations, but was more difficult to quantify. The information collected under this strategy helped to identify specific wildlife attractants and patterns that often provided the most useful observations for understanding and resolving wildlife hazards. Many of these observations occurred when other activities, such as moving from one survey point to the next, were being conducted, and often lead to the general understanding wildlife species utilization of the airport property. Other than direct sightings of wildlife outside of standard surveys, the most notable example of a general observation was seeing wildlife sign such as tracks, scats, or other evidence (e.g., beaver dam). This kind of information was instrumental for the observers to "sense" what kind of activity was occurring and therefore was not always recorded.

7.5 Off Site Wildlife Surveys

Advisory Circular (AC) 150/5200-33B (http://www.faa.gov/documentLibrary/media/advisory_circular/150-5200-33B/150_5200_33b.pdf) regarding hazardous wildlife attractants on or near airports states that caution should be exercised to ensure that land use practices on or near airports do not enhance the attractiveness of the area to hazardous wildlife. Future attractants should be created >5 miles away from Boire Field, if possible, when the attractant could cause hazardous wildlife movement into or across the approach or departure airspace. Nine off-site locations were selected for observation due to their proximity to the airport and potential attractiveness to hazardous wildlife. Figure 7 shows Boire Field's 5 mile critical airspace and

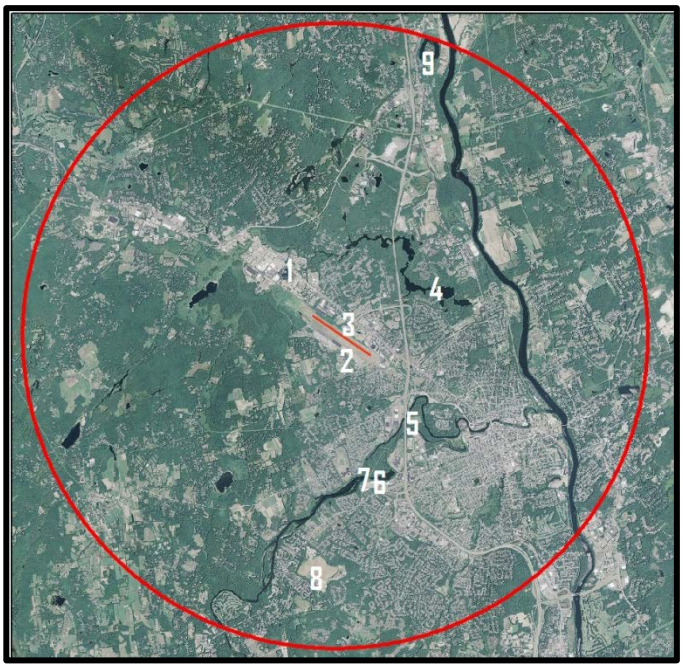


Figure 7. Boire Field's 5 mile critical airspace and monitored off site wildlife hazards surveyed from October 2013 through September 2014.

identifies the nine off-site locations (1-9), listed below. These sites included Round Pond (1), Spectacle Brook (Daniel Webster College Marsh) (2), Bertucci's Restaurant pond (3), Pennichuck Watershed and Manchester Street (4), Mine Falls Park at Soifert Playing Fields (5), Mill Pond (6), Boat Launch at Mine Falls Dam (7), Four Hills Landfill (8) and Horseshoe Pond in Merrimack (9). Data collection was similar to the on-site method with the exception of time. The length of time was determined by the total amount of time (between 3-5 minutes) it took to document all species observed at the off-site location. Various other wildlife hazards (ex. open spaces, parks, commercial complexes, ponds and golf courses) exist within Boire Field's 5-mile critical airspace. WS objective of Boire Field's WHA was to investigate wildlife activity at attractants in close proximity to the airfield, as well as larger bodies of water within its airspace.

7.6 Guild Classifications

For simplification of analyses, wildlife species observed during the WHA were classified into guilds. Guild classifications were based on observed activities and behaviors of each species during the assessment. Animals with similar behaviors and habitat requirements can generally be managed by similar techniques. The following guild classifications may differ from those found in literature regarding animal taxonomy; however, they still correspond with traditional taxonomic classifications. The guilds listed below represent wildlife species observed at Boire Field that pose potential threats to aviation safety.

Columbids

Rock doves, commonly referred to as pigeons or rock pigeons, and mourning doves are common throughout New Hampshire and are considered gregarious (flocking) in behavior. Pigeons are abundant in cities and farms. Mourning doves are also widespread throughout the area, and are especially abundant in the more open rural setting. Doves are powerful fliers with robust bodies, small heads, and short beaks. Mourning doves flock most of the year and typically fly close to the ground near cover as they travel between feeding and roosting areas. Pigeons tend to fly at higher altitude, descending to their destination in a rapid circling pattern wings spread back. Although both species are primarily grainivorous, they will occasionally consume protein rich animal matter such as insect larvae. Pigeons are known for readily accepting handouts from humans. Mourning doves are commonly found near wooded streams, in agricultural and weedy fields and in urban areas. Freshly seeded bare ground and grassy areas that are allowed to go to seed are strong attractants for doves. Feral pigeons, on the other hand, are found in urban and agricultural areas, generally in close association with people. Large, open buildings, such as hangars and parking garages often provide desirable nesting areas (e.g. flat surfaces and ledges, metal I-beams, etc.). Both species were documented at Boire Field during spring, summer and fall. Columbids utilized the airport's grassland for seeds, unpaved areas for grit, which is necessary for digestion and perched on the perimeter fence, especially on the fences north of the runway approach light area, and south of the localizer safety area.

Corvids

American crows and common ravens are members of the family Corvidae and are very closely related in appearance and behavior. Birds of this guild are omnivores and capable of consuming a wide range of food types including: fruits, grains, seeds, nuts, small animals, insects, refuse and carrion. Crows are medium-sized birds that often exist in large flocks and utilize a variety of habitats including open, grassy areas; therefore, they can pose a significant threat to aircraft. Crows commonly feed in open areas, especially when there is dense cover nearby such as trees or heavy brush. Compared to crows, ravens are larger, more solitary, and use forested habitat to a higher degree. Both species are well adapted to forage on a wide variety of food sources. Blue jays are also a member of this family and their abundance and behaviors are more similar to ravens than crows, although they are considerably smaller. Corvids reside in New Hampshire year round and were observed frequently throughout the entire WHA in all habitat types at Boire Field, especially woodlands and grassy areas.

Flocking Birds

This Guild consists of many of the species that belong to the family Icteridae. Small birds such as: European starlings, red-winged blackbirds, bobolinks, brown-headed cowbirds, horned larks and snow buntings make up this group. All of the members of this guild are gregarious or flocking birds, and are known to form large flocks during the winter months. In the case of European starlings flock size can range in the thousands. Flocks typically form in nearby areas with suitable roosting sites and adequate foraging habitats. Although, individually these birds are smaller in size, it is their propensity to gather in large flocks that makes them a hazard to aviation safety.

European Starlings and blackbirds are opportunistic feeders and consume a variety of foods, including fruits, grains, weed seeds and insects. Birds within this guild are found in and around urban and suburban areas, at airports, grassy areas, weedy fields or fallow crops fields. All members of this guild are native to North American, with the exception of the European Starling. European starlings were introduced into the United States in the 1890's and quickly spread throughout North America. The European Starling is a cavity nester and seeks out nesting areas with both suitable nesting cavities, usually near buildings and short grass areas for foraging.

Larks and buntings are small bodied birds adapted to field or upland habitats. They have slender thin bills and feed on seeds and insects. In the winter months, horned larks and snow buntings form mixed flocks.

Passerines

The Passerine guild is the largest and most diverse guild comprised of many small perching bird species. This guild consists of more than half of all avian species worldwide including, American robins, Eastern meadowlarks, woodpeckers, finches, sparrows and warblers. Food and habitat preferences vary considerably within this guild depending on the individual species. Members of this guild can be attracted to buildings, brush piles, shrubs, weedy fields, grasslands, woodlands and marshes. Many of the species within this guild feed on insects and other invertebrates during the spring, summer and fall

months, and feed on seeds, fruits and grains in the winter. Passerines are small to medium in size and are generally considered less hazardous to aviation; however, large flocks can present a strike risk to aircraft. Passerines were often observed at Boire Field perching on fencing, navigational aids and vocalizing within herbaceous and woodland habitats.

Raptors

This guild is comprised of eagles, hawks, owls, falcons and turkey vultures. They range in size from small to large birds that prey on other birds, small mammals, carrion, reptiles and fish. Many raptors are attracted to airports which offer an abundant supply of prey species in a predominately open space. Soaring birds in this guild are further attracted to airports by thermals, columns of warm air that rise when the ground is heated by solar energy. Raptors use these upward moving columns of air to conserve energy when soaring over potential hunting grounds. Large trees or snags at the edge of fields further exacerbate the attractiveness of airports by providing perch and nesting locations. At Boire Field, raptors were commonly observed perching on navigational aids along the runway, hunting in the infield or soaring over or adjacent to the airfield. Raptors utilizing the airport environment pose a significant threat to aviation due to their size and behavioral characteristics.

Gulls

Gulls are large bodied, robust birds with webbed feet, long pointed wings, and stout bills. Gulls are commonly attracted to airports when food or water is available. Food sources may include refuse from dumpsters and landfills, invertebrates or carrion. These birds become habituated quickly to easy sources of food such as handouts from construction sites and parking areas. Airport infields, temporary standing water, parking lot light posts and rooftops provide ideal loafing attractants for gulls particularly when weather is foggy or when gulls seek protection from storms. Gulls will also gather on paved areas after it rains to feed on earthworms, which emerge from the saturated soil.

Waterfowl

The waterfowl guild consists of medium sized to very large birds including ducks, geese and swans that are attracted to open water sources. Generally, waterfowl feed on a variety of aquatic material including vegetation, invertebrates and fish. The birds in this guild are largely migratory, therefore, may be present in higher numbers on a seasonal basis. However, non-migratory populations of geese and ducks inhabit many areas surrounding Boire Field. Due to their body size and flocking behavior, waterfowl (particularly Canada geese) pose serious risks to aircraft safety. Ducks are rarely seen feeding, loafing or roosting away from water, even if only a puddle. Canada Geese will land on nearly any size field or lawn where they can watch for predators while feeding. Nesting is usually done near or in wetlands, on islands, in tree cavities or in thick vegetation. However, it is not unusual for ducks or geese to nest a considerable distance from water in fields, parking lots and landscaped vegetation.

Both migratory and resident populations of Canada Geese are found in New Hampshire. Migratory Canada geese pass through during the spring and fall migrations. Resident Canada geese are

those that nest and reside predominately in the Continental U.S. and do not migrate north and south. They are able to tolerate human and other disturbances, while proliferating in urban, suburban and rural environments. Waterfowl prefer to roost in open water at night to avoid predation or other risks. Geese and ducks tend to leave their roost near sunrise to locate a feeding area. They return to their roosting areas during or just after sunset. Canada geese will sometimes also be seen foraging at night.

Resident Canada Geese molt all of their flight feathers and grow new ones from June through August leaving them flightless. During this period, they require feeding areas to be adjacent to open water for night roosting. Intensively harassing geese away from the airport before the molt will ensure they go flightless somewhere else. Geese nested at Boire Field in the vicinity of Ponds 2 and 3 and at the Daniel Webster College Marsh, located just outside the perimeter fence on the south side of the airport.

Upland

Upland birds include wild turkeys, woodcock and ruffed grouse. Upland birds feed on acorns, nuts, fruits, seeds, tree buds and insects. Ruffed grouse will also eat small snakes and frogs. Woodlands and secondary growth on and around the airfield provide roosting, foraging and nesting habitat. Most of the birds in this guild are managed by the NHFG through regulated hunting seasons.

Wading and Shorebirds

The wading bird and shore bird guild is comprised of two groups. Wading birds, which include the egrets and herons, are generally solitary, medium to large, long legged birds that typically feed along the water's edge or by wading in shallow water. Shore birds include killdeer, sandpipers and plovers, and can be either solitary of flocking. Shore birds are small to medium sized birds and typically feed on beaches, mud flats and upland woods and grassland where they can hunt for small to medium-sized fish, amphibians, insects and other invertebrates.

Mammals

Mammals observed during Boire Field's WHA consisted of small rodents and herbivores (mice, voles and woodchucks), small and medium-sized carnivores (skunks and raccoons; and coyotes and foxes) and large herbivores (white-tailed deer). Small mammals are considered an indirect hazard to aircraft at Boire Field, because they provide a prey base for larger, more hazardous species, such as, carnivores and raptors. Typically, the greater the abundance of small mammals available on an airfield the more attractive the airfield is to predators. White-tailed deer observations were a common occurrence on the airfield throughout the study during spotlight surveys. On a few occasions, coyotes and foxes were observed on and near the airfield. Large herbivores such as deer are hazardous to aircraft because of their size and ability to cause significant damage to aircraft if struck.

7.7 Data Analysis

The data was analyzed using Microsoft Excel® to determine total wildlife abundance and observations among survey periods and during all months of the assessment. Daily and seasonal wildlife

trends were identified for each guild to represent temporal wildlife activity at Boire Field. In addition, ArcGIS 10.2 (Environmental Systems Research Institute 2013) was used to display spatial locations of wildlife observed and to provide aerial photo mapping of areas of increased wildlife use on the airfield. Results of the analysis are intended as spatial and temporal indices and not as wildlife population estimates for Boire Field. Spotlight data was analyzed to determine the extent of hazards, specifically mammals, occurring at night. Because there was no hypothesis being tested, other statistical analysis was not necessary.

8.0 Results and Discussion

8.1 Wildlife Surveys

From October 2013 through September 2014, Wildlife Services conducted 120 on-site wildlife surveys at Boire Field. Survey results yielded 2,962 wildlife observations totaling 9,197 individuals (abundance) among 119 species (Figure 8). Abundance was defined as the number of individuals for a given species counted during an observation. Conversely, an observation was defined as one instance, or account, of wildlife observed whether one or multiple individuals were observed.

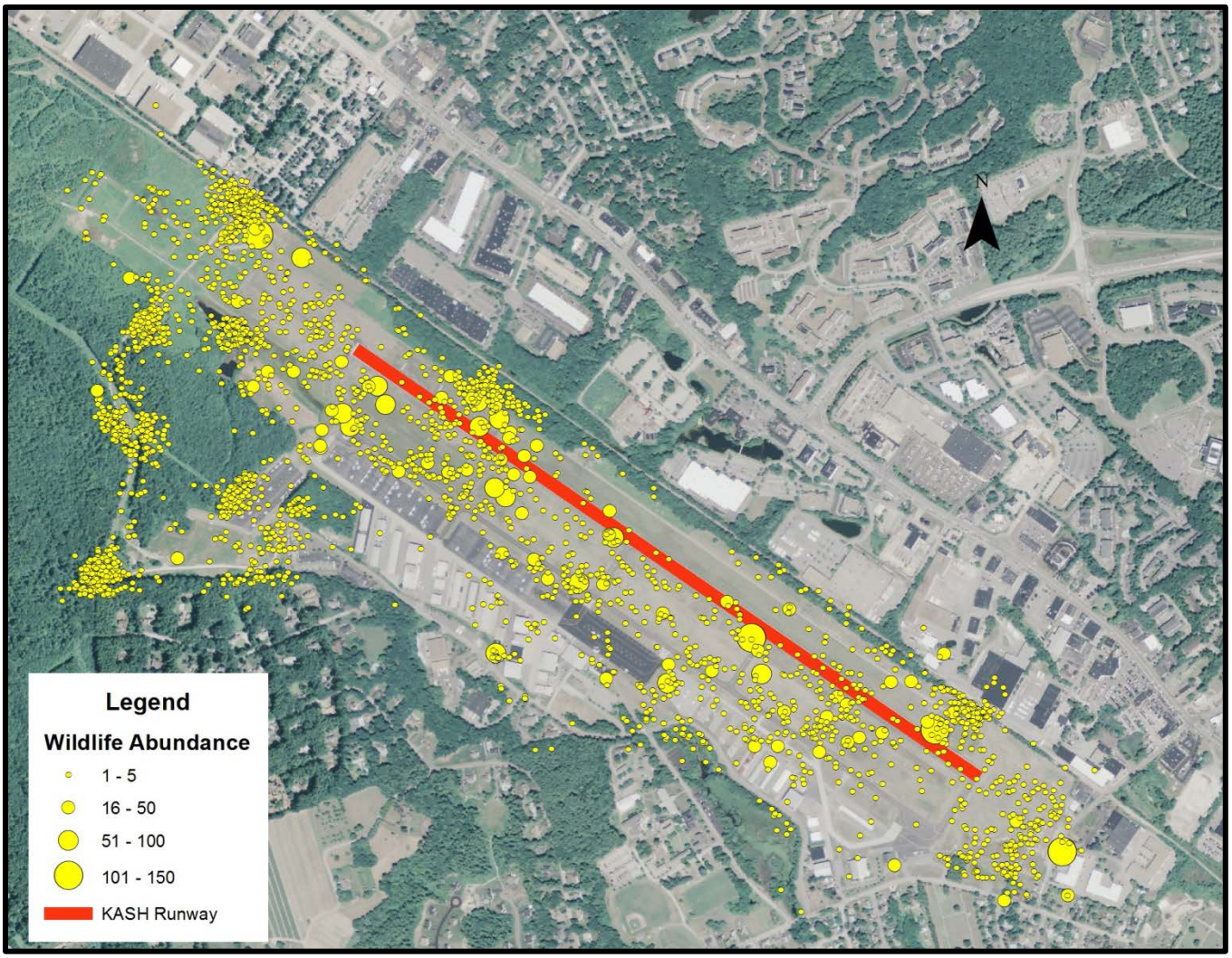


Figure 8. Locations of all wildlife observed during Boire Field's WHA from October 2013 to September 2014

Wildlife species were categorized into nine avian guilds, one reptile and amphibian group and one mammalian group. The charts below represent differences between wildlife abundance and number of observations. Flocking birds, Passerines and Waterfowl accounted for 74% of the total number of individual wildlife species counted at Boire Field (Figure 9). However, Passerines, Corvids and Flocking birds accounted for approximately 73% of all observations of wildlife at Boire Field (Figure 10).

For example, although flocking birds only accounted for 12% of all observations, the total count of the species in this guild accounted for 42% of all wildlife at Boire Field.

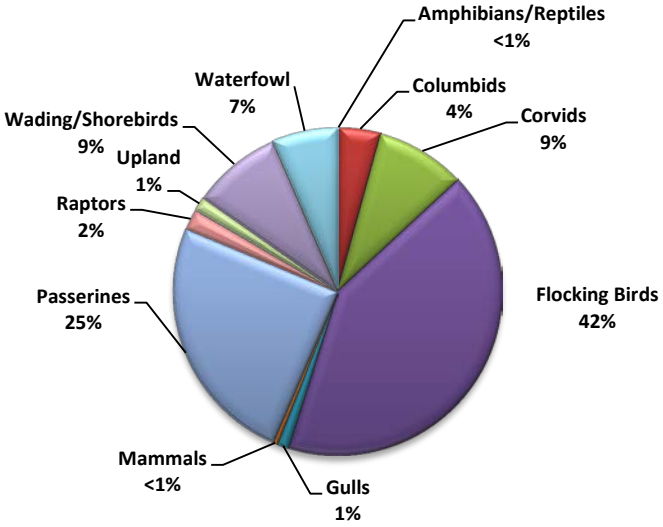


Figure 9. Percentage of abundance within each guild observed during Boire Field's WHA from October 2013 through September 2014.

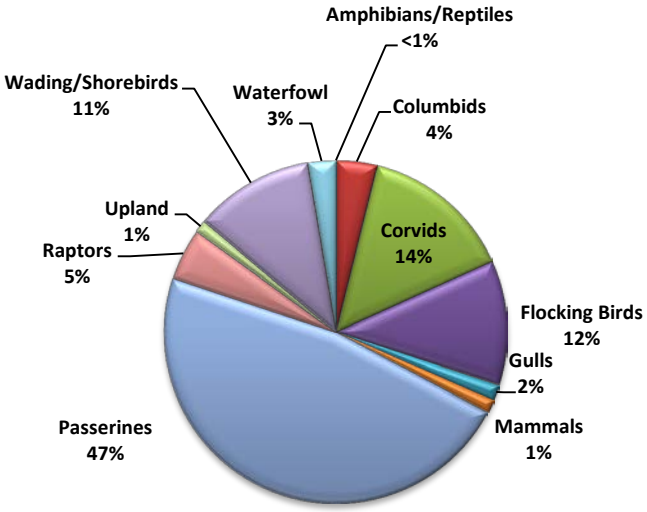


Figure 10. Percentage of observations within each guild observed during Boire Field's WHA from October 2013 through September 2014.

Across guilds overall wildlife abundance varied. Flocking Birds and Passerines exhibited the highest abundances (greatest number of individuals counted) by species followed by Corvids and Wading/Shorebirds (Figure 9). During the WHA brown-headed cowbirds were the most abundant bird species observed followed closely by horned larks, European starlings and snow buntings (Appendix A).

In addition, white-tailed deer and woodchucks were the most frequently observed mammals at Boire Field.

Wildlife survey data listed in Table 5 below summarizes the total number of wildlife observed by guild during the WHA. *Abundance* is the total number of individuals documented during the WHA or, more appropriately, the number of "wildlife hazard occurrences" observed during the WHA. Because any wildlife species present on the airfield could potentially move onto or over the runway, the occurrence of any species is considered a potential risk to aviation safety. *Percent Observed* indicates the percentage of surveys that any species representing a particular guild was observed. This percentage represents the probability of occurrence for any species within a particular guild observed on the airfield at any given time. The *Maximum Number* identifies the largest number of individuals observed in a group/flock for a particular guild observed during surveys. Small, solitary birds do not necessarily pose a threat to aviation; however, large flocks of small birds can potentially be hazardous to aircraft. This table provides insights regarding the number of animals that the airport director, operations manager or the designated wildlife coordinator may expect to encounter when managing wildlife.

Table 5. Guild abundance and frequency of occurrence during Boire Field's WHA from October 2013 through September 2014.

Guild/Group	Abundance	Percent Observed	Max Number
Amphibians/Reptiles	16	<1	10
Columbids	369	4	30
Corvids	809	14	16
Flocking Birds	3813	12	120
Gulls	105	2	12
Mammals	42	1	3
Passerine	2266	47	100
Raptors	184	5	5
Upland	130	<1	13
Wading/Shorebirds	806	11	30
Waterfowl	591	3	50

All wildlife observations were documented across 14 activities (Table 6) and 26 habitat types (Figure 11). For all wildlife observations, vocalizing (39.8%), perching (15.1%) and feeding (14.6%) accounted for the highest number of wildlife activities (Table 5). The top four habitat designations for wildlife occurrence were woodlot (34%), short grass (27%), shrubs (8%) and long grass (5%) (Figure 11). This makes sense, in light of the fact that majority of the airfield is covered by wooded areas, infrequently mowed (high grass/shrub) and frequently mowed (infield and safety areas).

Table 6. Activity occurrence for all wildlife observations at Boire Field from October 2013 through September 2014.

Activity	Percent Occurrence
Vocalizing	39.8
Perching	15.1
Feeding	14.6
Standing	11.4
Flying Localized	7.2
Flying Passing	6.5
Loafing	3.0
Hawking Insects	1.1
Towering	0.5
Running	0.5
Hovering	0.3
Nesting	0.1
Swimming	.07
Roosting	.03

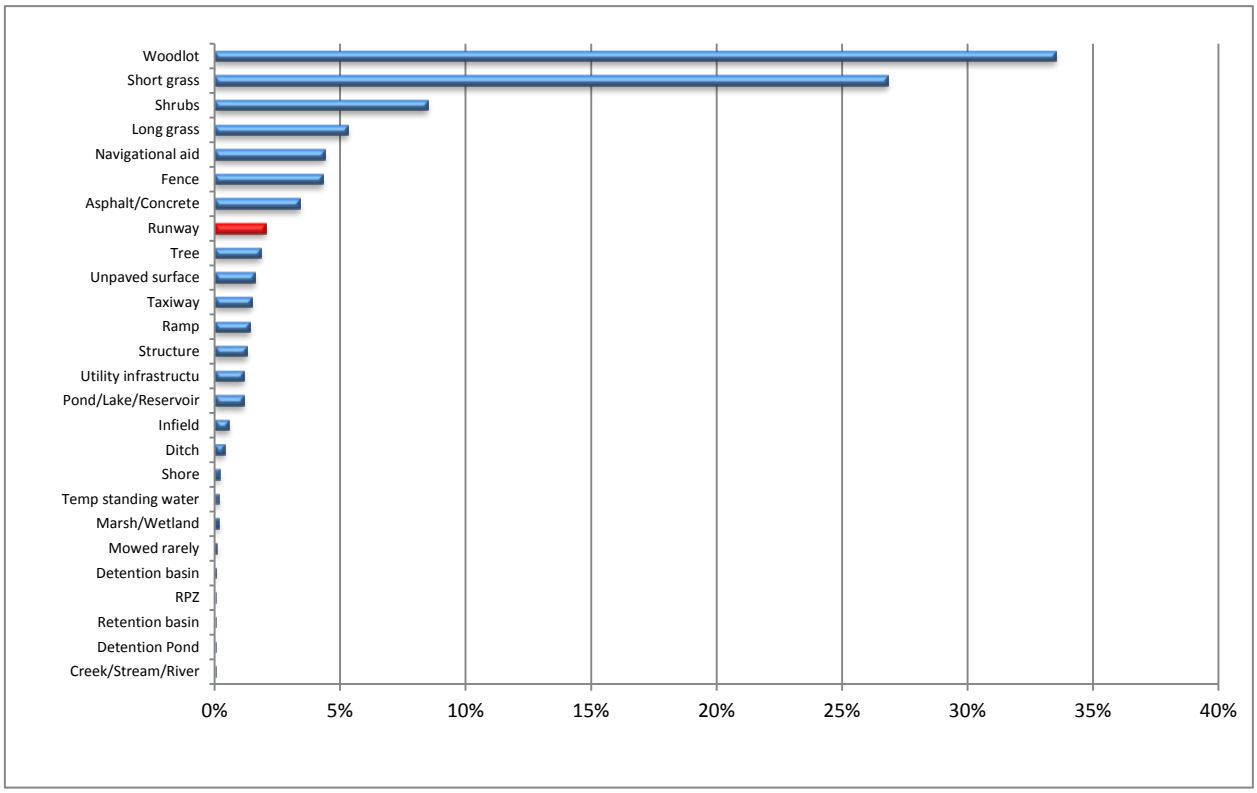


Figure 11. Occurrence of wildlife by habitat type for all wildlife observations at Boire Field from October 2013 through September 2014.

Wildlife populations are dynamic and their use of the airfield can vary daily, seasonally and annually. During the WHA, the greatest abundance of wildlife was recorded during morning and evening surveys (Figure 12), during spring migration and summering periods (April through July; Figure 13). The greatest number of observations of wildlife was in the morning (Figure 12) and during spring migration and breeding season (Figure 13).

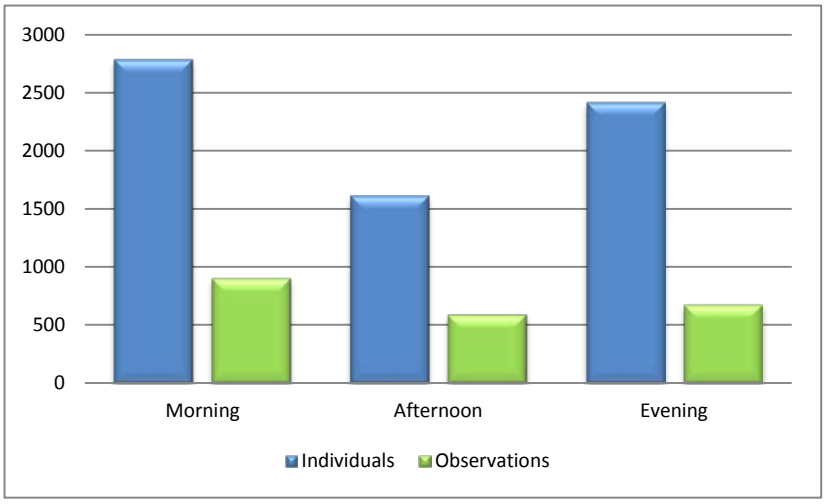


Figure 12. Wildlife abundance (individuals) and observations for each survey period during Boire Field's WHA from October 2013 through September 2014

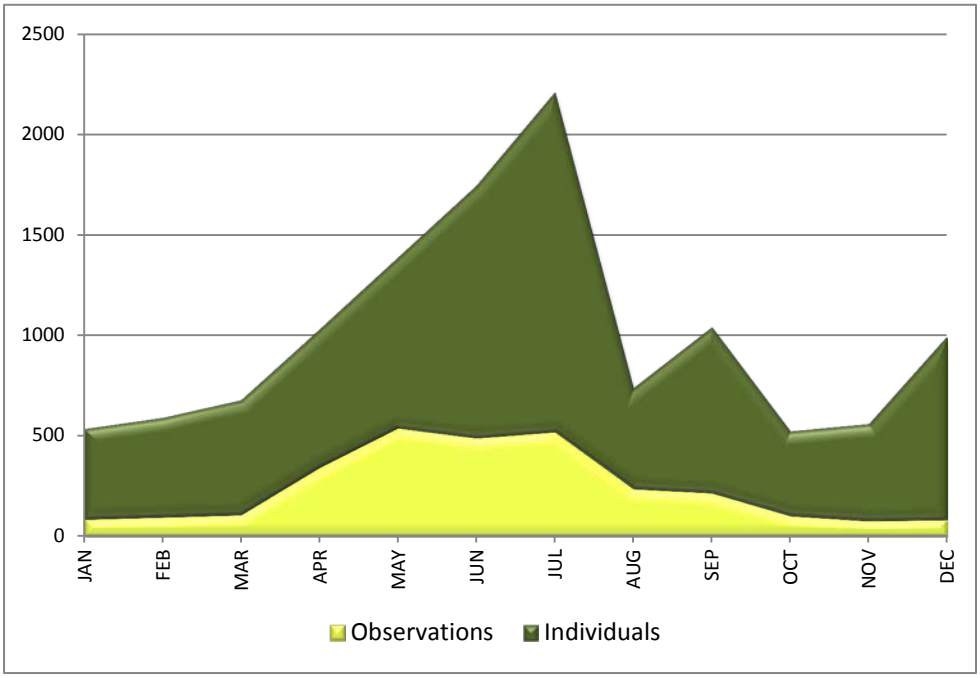


Figure 13. Monthly wildlife abundance (individuals) and observations during Boire Field's WHA from October 2013 through September 2014.

8.2 Columbids (Mourning and Rock doves)

Nationally, from 1990 through 2013, Columbids accounted for 7.4% of all bird strikes and 3.7% of strikes involving damage totaling $20,811,339 (Dolbeer et al. 2014). At Boire Field, Columbids accounted for 14.3% percent of strikes from 1990 to the present resulting in minor damage to one aircraft with no reported cost of repairs. During the WHA Columbids were observed 112 times consisting of 369 individual birds (Figures 14, 15). This accounts for 3.9% of bird survey observations and 4.1% of individual birds counted during the WHA. Peak activity of Columbids was observed during morning and evenings surveys (Figure 17). Columbids were commonly observed perching (47%), feeding (27%) and loafing (8%). These activities occurred over/on fence (31%), short grass (27%), unpaved surfaces (10%) and utility infrastructure (9%) (Figure 16).

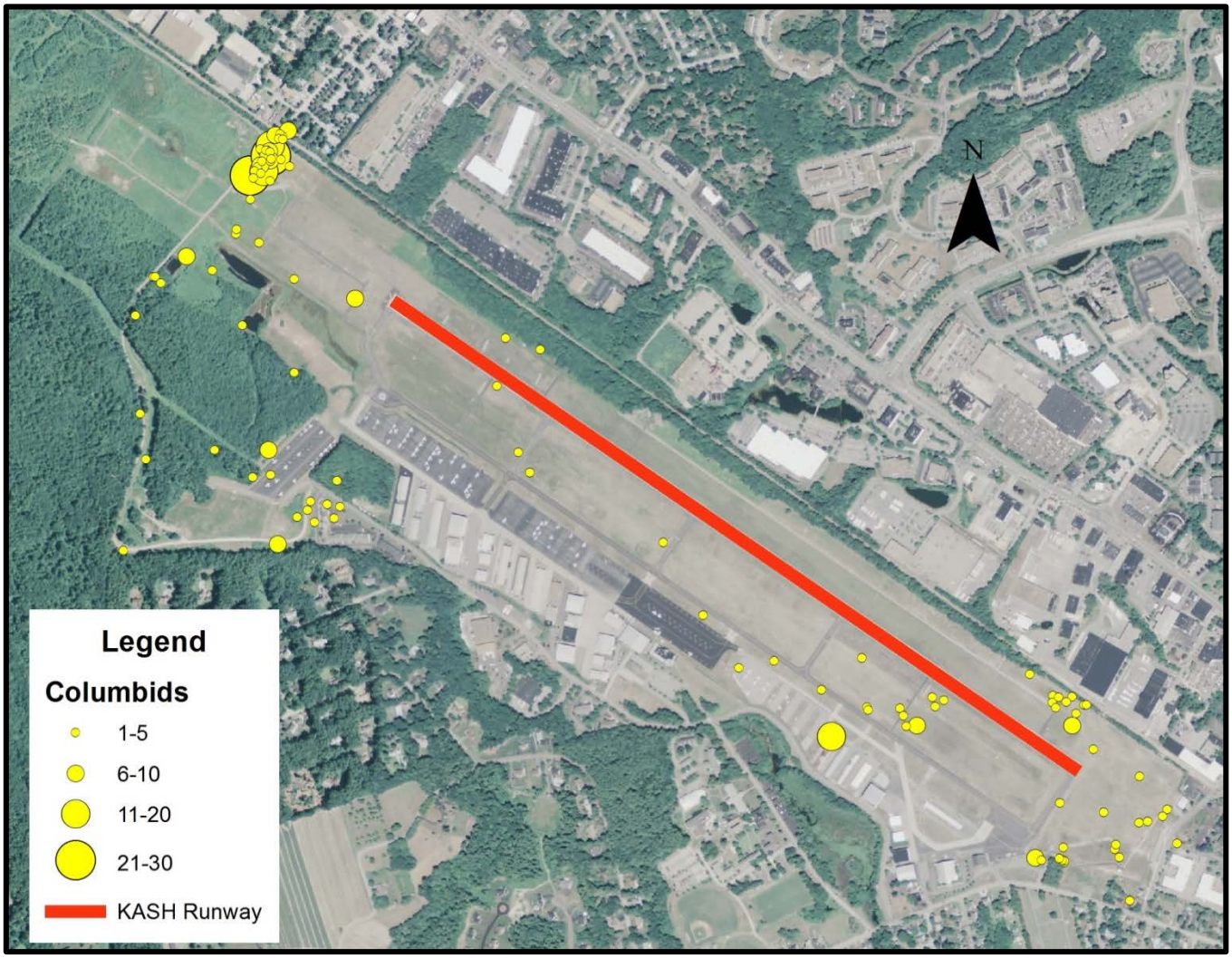


Figure 14. Columbid locations during Boire Field's WHA from October 2013 through September 2014.

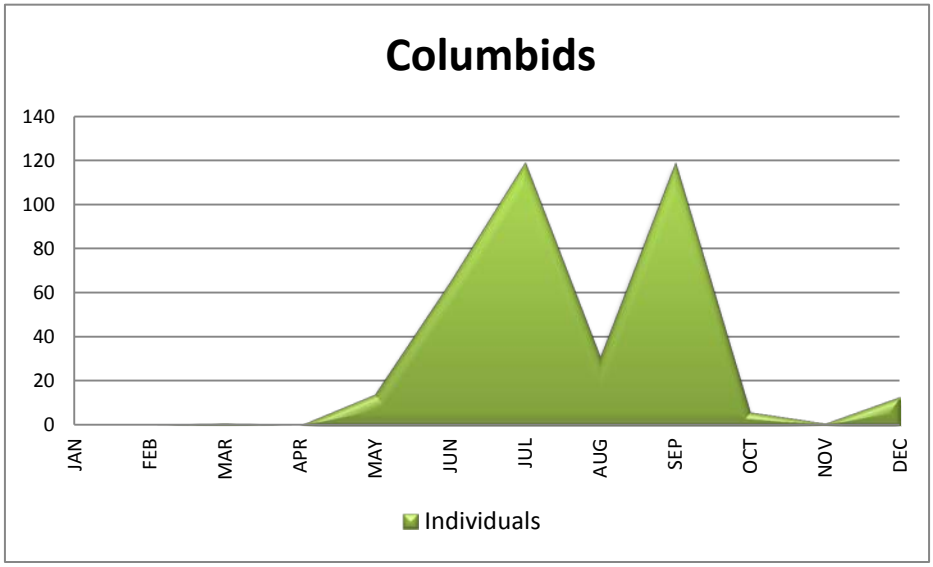


Figure 15. Columbid abundance for Boire Field's WHA from October 2013 through September 2014. The highest abundance of Columbids occurred in summer

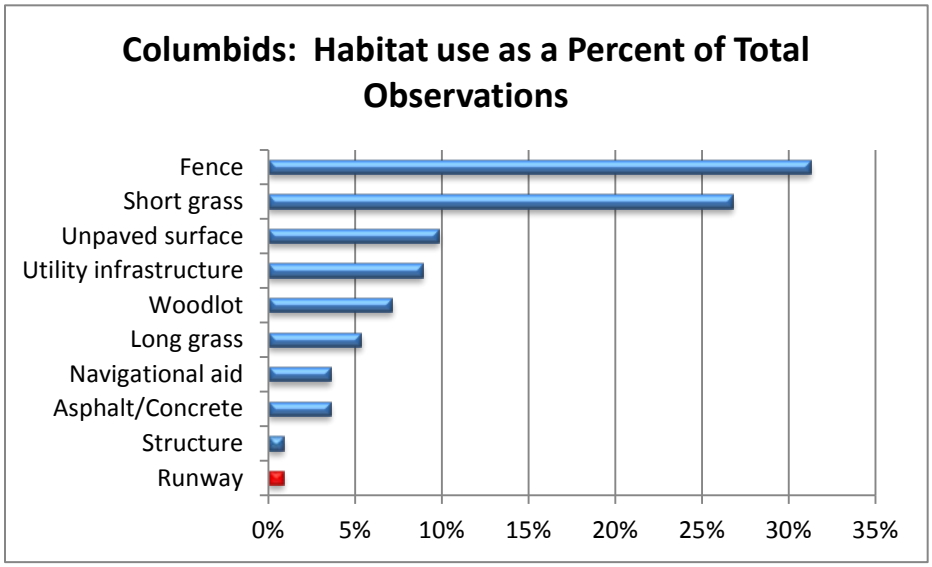


Figure 16. Columbid use of habitat for Boire Field's WHA from October 2013 through September 2014.

Damage

Doves and pigeons at Boire Field pose a threat to air safety and therefore merit control measures. These birds have tight flocking behavior and dense body structure, which increases their potential to damage an aircraft. Another concern includes property damage to building structures and airplanes. Pigeon droppings are corrosive to painted and metal surfaces and their droppings can contain several infectious pathogens such as cryptococcosis and histoplasmosis. Therefore, it is recommended pigeons observed utilizing hangars and other structures be managed using exclusion and direct control techniques.

Legal Status

Feral pigeons are not regulated by Federal or State laws and can be lethally removed at any time. Mourning doves however, are migratory game birds and are regulated by Federal and State regulations and permits or hunting licenses are required for lethal control actions. If Mourning doves warrant lethal control, they must be listed on the annual depredation permit before they can be lethally removed

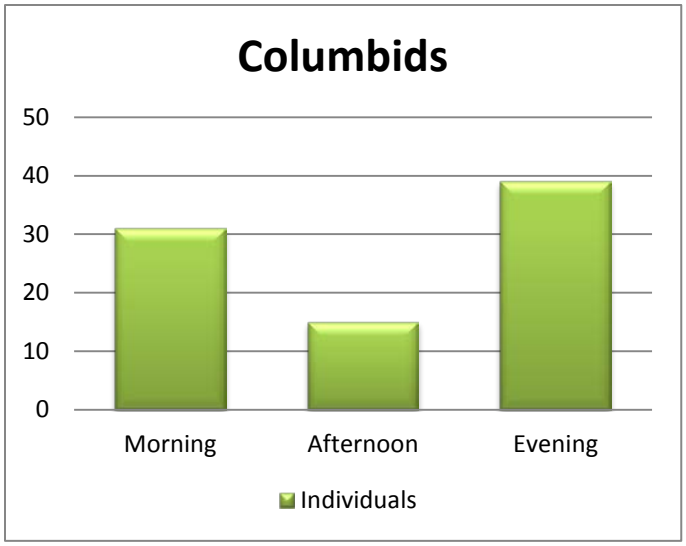


Figure 17. Columbid abundance during each survey period for Boire Field's WHA from October 2013 through September 2014.

Control Measures

Habitat modification is the best solution to control dove and pigeon problems. Habitat modification helps reduce the numbers of pigeons and doves directly using the airfield. Mowing should occur before grasses and forbs go to seed to reduce seeds available for food. Areas disturbed by construction or other activities should be seeded with Little Bluestem (*Schizachyrium sp.)*, Tall Fescue (*Festuca sp.*) or other grasses that produce few seeds and/or are unattractive to wildlife. Existing grass and forbs should be replaced if they are found to attract birds to the area. When and if possible, paved surfaces and drainages should be kept free of standing water.

In structures where pigeons are roosting and nesting, trapping and/or shooting are effective means for removing offending animals. Lethally removing pigeons can be done with the use of an air rifle (caution must be exercised when using an air rifle in close proximity to aircraft, people and sensitive structures). If nest removal is employed, the nest may need to be removed several times before a pigeon abandons a nesting area. Once the birds are removed, exclusion netting or other barriers should be installed to reduce or eliminate roosting and nesting. Changing cultural practices such as closing hangar doors and dumpster lids when not in use and enforcing prohibitions against feeding birds on the airport can also reduce pigeon use of facilities. Structural repairs, such as replacing broken windows, are also important to limit birds accessing buildings for roosting and nesting.

New construction should be designed and built to deter pigeons and other birds from using the structure. This can be accomplished by reducing or eliminating exposed ledges, spaces between duct work and ceilings, openings and cavities in the initial design of the structure.

Including exclusion netting, Nixalite and/or other mechanical barriers and repellents in the design and installing them during construction will reduce or eliminate potential bird problems and will cost less than an installation after the structure is constructed. Exclusionary techniques are most effective when birds are initially attempting to colonize an area. Boire Field employees and tenants must be discouraged from feeding feral pigeons and other birds.

8.3 Corvids (crows, jays, ravens)

Corvids can cause severe damage to aircraft. During the winter, Corvids tend to form larger flocks which increases the likelihood for the entire flock to find food but also increases the potential to cause damage if struck by an aircraft. They are the most widespread bird species in North America and are known for scavenging animal carcasses and feeding on human garbage. They are also predators that hunt rodents, amphibians, reptiles and small birds.

Nationally, from 1990 through 2013, Corvids accounted for 0.5% of all bird strikes and 0.5% of strikes involving damage totaling $2,612,308 (Dolbeer et al. 2014). At Boire Field, Corvids accounted for 0% percent of strikes from 1990 to the present. During the WHA, Corvids were observed 417 times consisting of 809 individual birds (Figures 18, 19). This accounts for 14.5% of bird survey observations and 8.9% of individual birds counted during the WHA. Corvids were active on the airfield all times of day with peak Corvid activity in the evening (Figure 21). Corvids were commonly observed vocalizing (49%), feeding (22%) and perching (8%). These activities were performed over/on woodlot (54%), short grass (29%), long grass (4%) and runway (2%) (Figure 20).

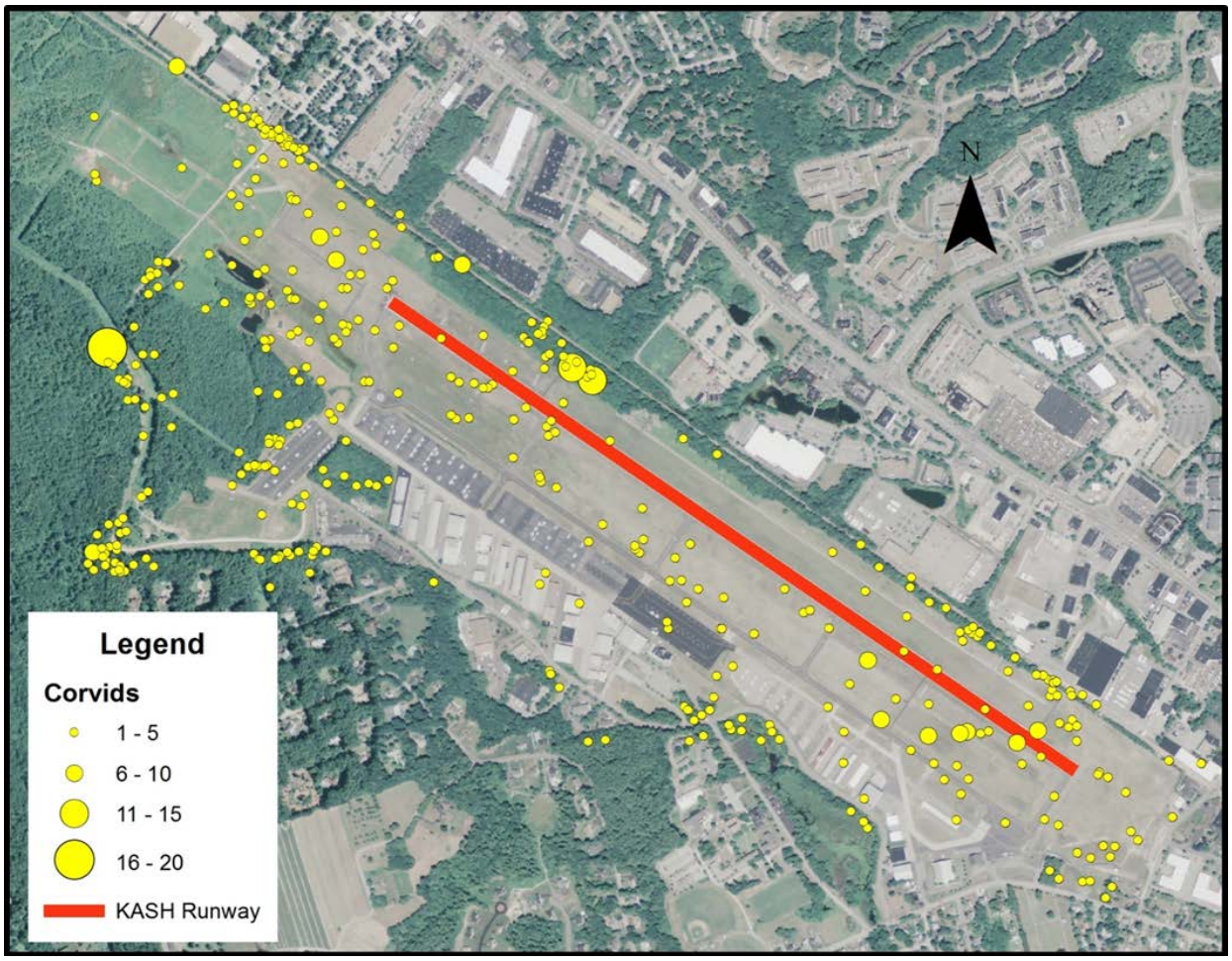


Figure 18. Corvid locations during Boire Field's WHA from October 2013 through September 2014.

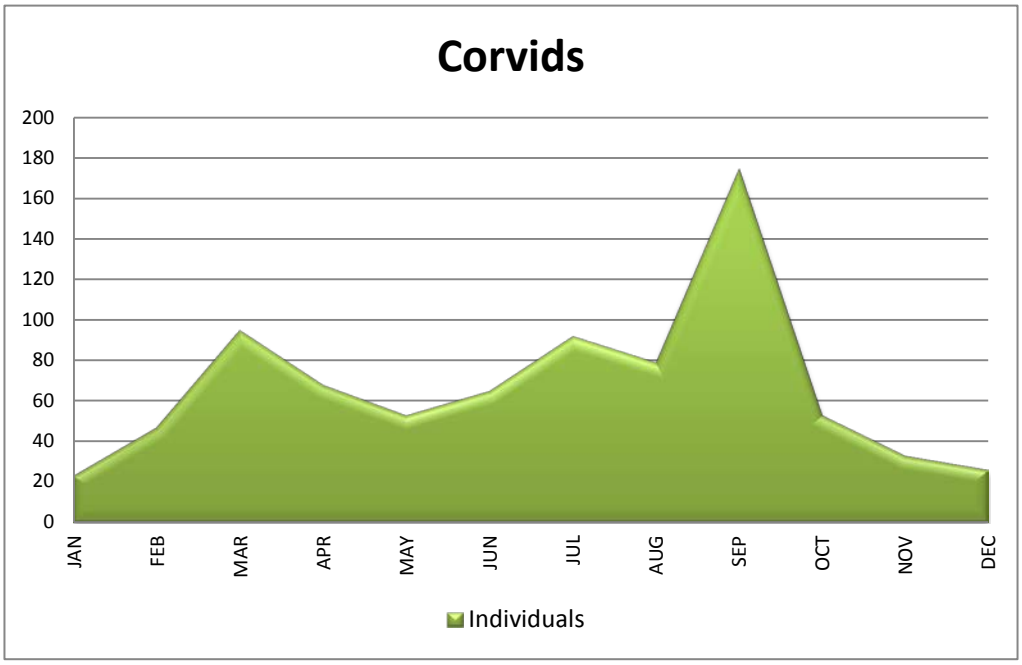


Figure 19. Corvid abundance for Boire Field's WHA from October 2013 through September 2014. The highest abundance of Corvids occurred in early spring, summer and fall months.

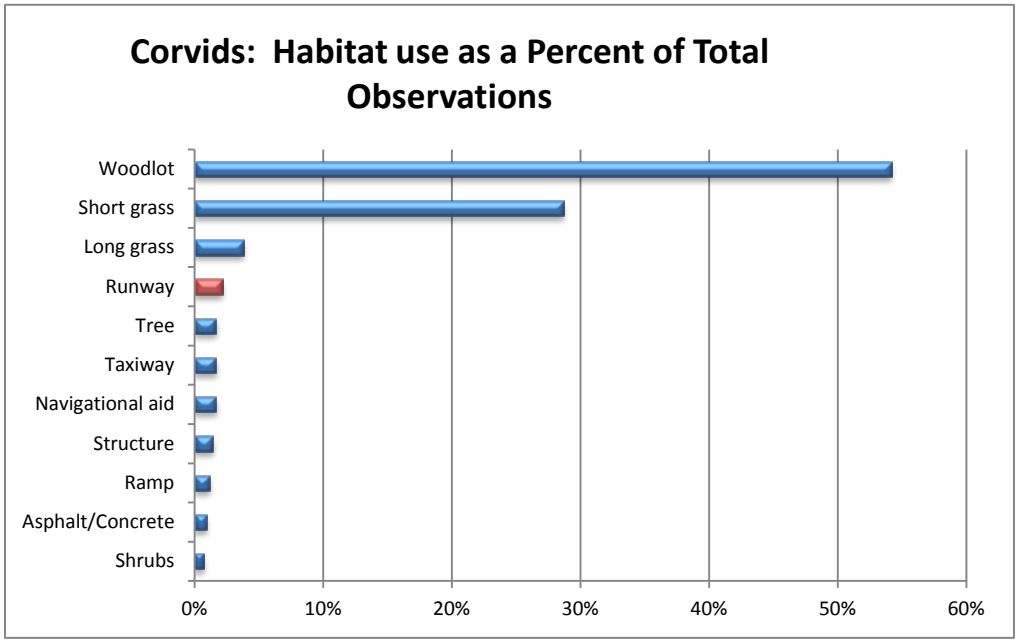


Figure 20. Corvid use of habitat for Boire Field's WHA from October 2013 through September 2014.

Legal Status

Corvids are migratory birds and are federally protected under the Migratory Bird Treaty Act, but certain species, such as crows, can be taken under the Federal blackbird depredation order (50 CFR Part 21, subpart D 21.43) when they are "…concentrated in such numbers and manner as to constitute a health hazard or other nuisance...". A USFWS depredation permit must be obtained in order to remove blue jays or ravens. American crows may be hunted statewide with a valid NH hunting license from mid-August – November and mid-March - March 31.

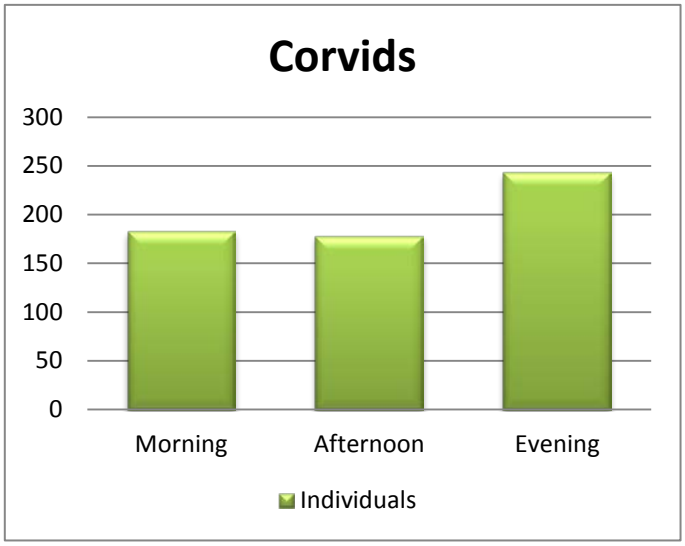


Figure 21. Corvid abundance during each survey period for Boire Field's WHA from October 2013 through September 2014.

Control Measures

The most effective method to prevent crows from using an airport is habitat modification. This method includes allowing the grass to grow taller than 7 inches, removing trees used for roosting and structures used for perching. Also, prey base reduction and the removal of carrion (road-kill), trees and refuse from airport surfaces are also effective. All trash dumpsters should be covered. Corvids can be hazed using pyrotechnics, bioacoustics and visual repellents, but they soon habituate to these devices if not enhanced by lethal reinforcement. The use of an air rifle or shotgun can be useful in removing specific hazardous individuals from the airfield.

8.4 Flocking Birds (starlings, blackbirds, snow buntings and horned larks)

Nationally, flocking birds accounted for 7.8% of all bird strikes and 2.2% of those strikes resulted in $10,465,011 in damages to civil aircraft from 1990 through 2014 (Dolbeer et al. 2014). At Boire Field, Flocking Birds accounted for 7% of strikes from 1990 to present resulting in no damages to aircraft. During Boire Field's WHA Flocking Birds were observed 341 times consisting of 3,813 individual birds (Figures 22, 23). This accounts for 11.9% of bird survey observations and 42% of individual birds counted during the WHA. Peak activity of flocking birds was observed during morning and evening surveys (Figure 25). Flocking Birds were commonly observed feeding (42%), flying localized (16%), perching (13%) and flying passing (13%). These activities occurred over/on short grass (57%), runway (6%), asphalt/concrete (15%) and long grass (5%) (Figure 24).

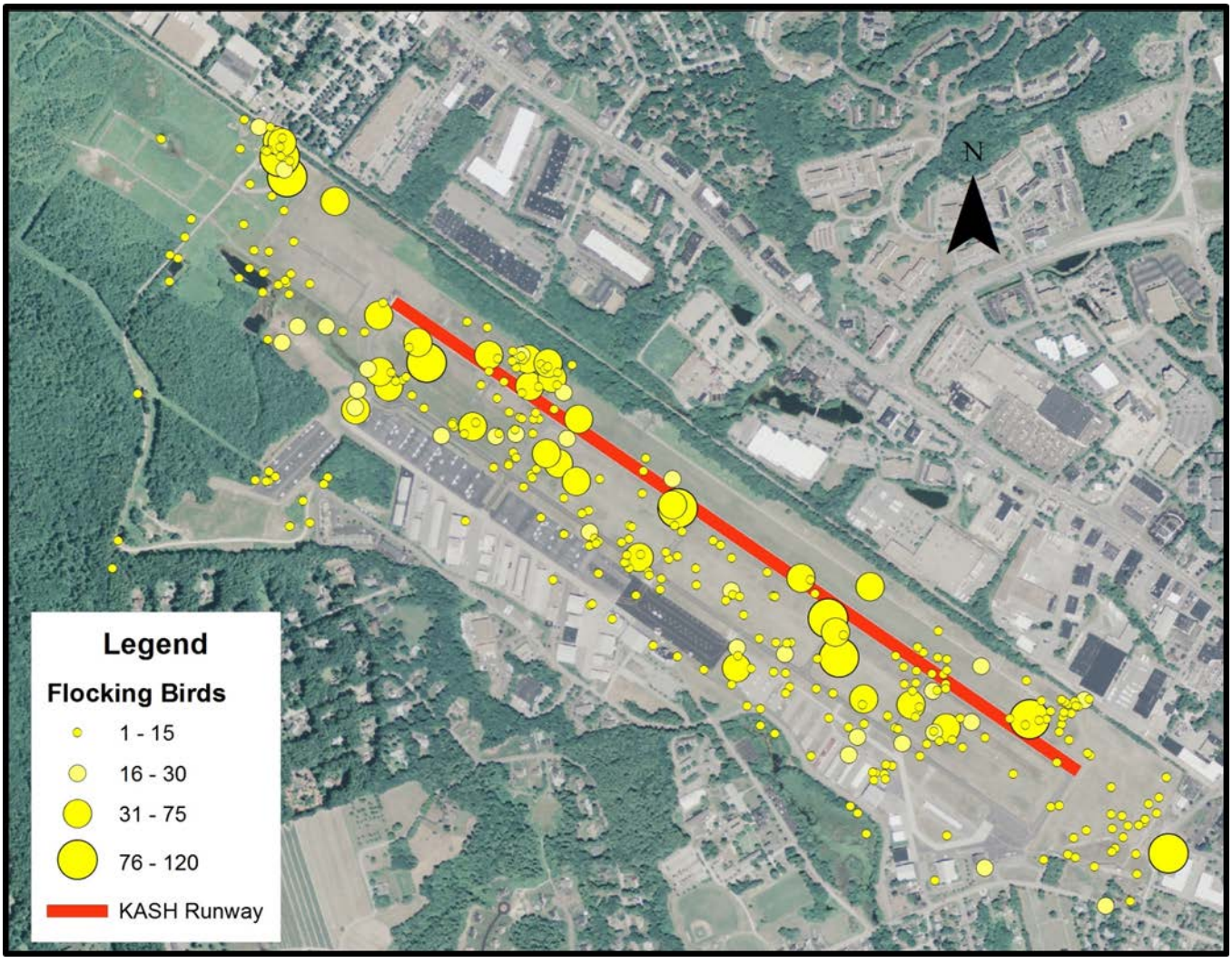


Figure 22. Flocking bird locations during Boire Field's WHA from October 2013 through September 2014.

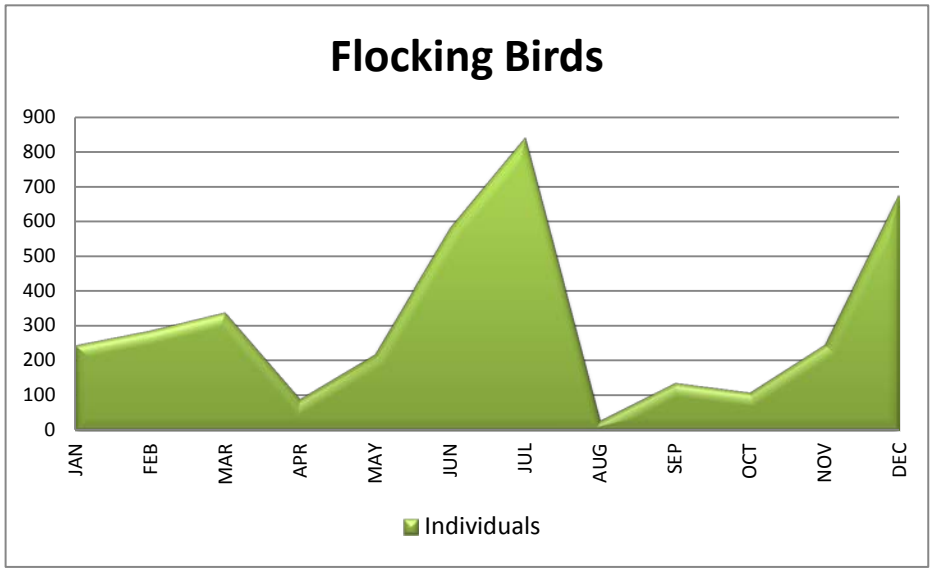


Figure 23. Flocking Bird abundance for Boire Field's WHA from October 2013 through September 2014. The highest abundance of Flocking Birds occurred in spring, summer and winter months.

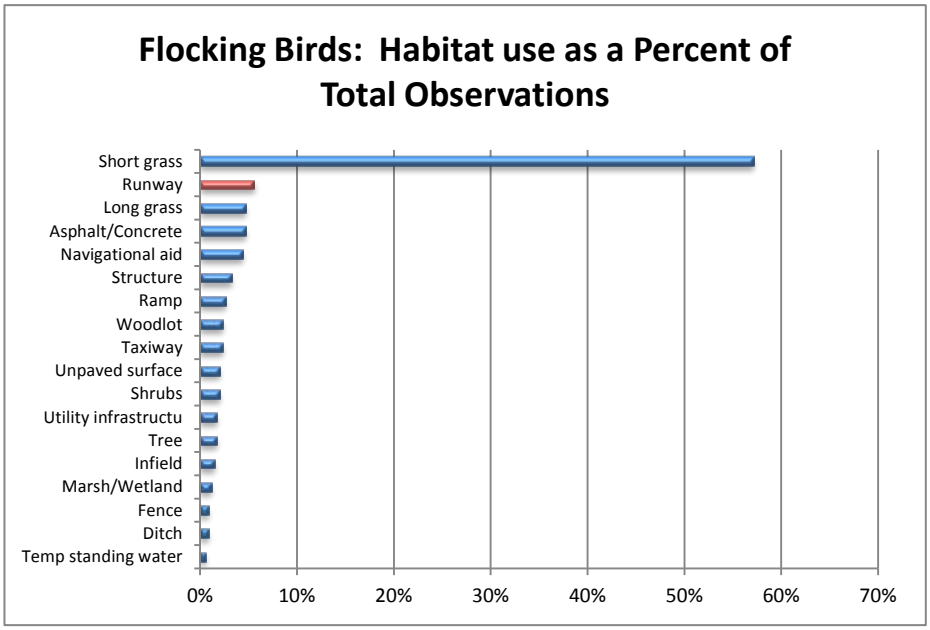


Figure 24. Flocking Bird use of habitat for Boire Field's WHA from October 2013 through September 2014.

Damage

This guild is considered extremely hazardous to aviation because of the large flocks they form and their relatively dense bodies as well as their gregarious flocking behavior and affinity for short grass and gravel next to runways. In particular, the European starling has a high density for its body size, making the bird even more hazardous. Winter roosts and spring breeding areas at an airfield present a nuisance because of noise, nesting material and droppings, which can corrode and damage buildings, kill trees and damage property (including aircraft). In addition, many infectious diseases can be spread by accumulation of fecal droppings. The presence of a flock of starlings, horned larks, snow buntings or blackbirds in or adjacent to AOA should be interpreted as a direct threat to human health and safety.

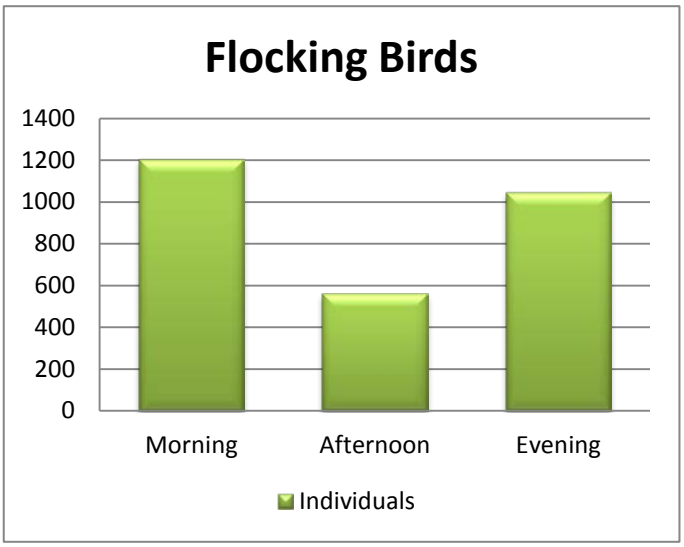


Figure 25. Flocking Bird abundance during each survey period for Boire Field's WHA from October 2013 through September 2014.

Legal Status

European starlings are an introduced species; therefore, they are not protected by Federal or State laws and can be taken at any time without a permit. Under the blackbird depredation order Blackbirds (red-winged, yellow-headed, brown-headed cowbird and grackle) can be taken without a Federal permit when they 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..." (50 CFR Ch. 21.43). Snow buntings and horned larks are considered migratory birds; therefore a Federal permit is required to remove these species when found on the airfield.

Control Measures

Habitat management (i.e., grass management, roost removal, etc.) is usually the most cost effective method to manage this guild because it serves as a long term deterrent. Grass height management has proven helpful in keeping starlings and blackbirds from feeding on airfields. The best grass height for an airport is 7" to 14". This, however, depends largely on local conditions such as grass stem density, grass variety, alternative food sources, weed species and density, etc. However, it is absolutely necessary to minimize seed head production in grass and weeds. This practice is wise management for all mower-accessible areas of the airport. Management of emerging insects, such as Japanese beetles, and grasshoppers may also prove useful in reducing the presence of starling and blackbird flocks on the airfield. Biological and chemical pesticides such as Milky Spore and Seven may

reduce the attraction of emerging insects. The management of roosting sites on or adjacent to an airport will also reduce starling and blackbird presence.

Habitat management alone may not be enough to discourage starlings and blackbirds. When flocks of black birds are observed, airport personnel should consistently haze them off the field using pyrotechnics and other methods. Often birds simply move to another location on the airfield so it is important to be persistent in hazing any bird species. Shooting as reinforcement to harassment or trapping as a population control method may be necessary if the birds become habituated to pyrotechnics or other non-lethal methods.

Lark and bunting management is difficult at best. Harassment with pyrotechnics has been met with mixed results. Some report the birds disperse as desired, others report the harassment results in dense flocking behavior which has a great potential to cause a damaging strike if a strike occurs. The best management approach is a comprehensive plan which includes the reduction of seed producing plants, the use of insecticides to reduce insect populations as well harassment with pyrotechnics as necessary and only if they are proving to be effective in dispersing the birds and are reducing the threat to aviation safety. In the winter months when larger flocks occur, both species prefer to loaf in plowed areas (asphalt, gravel roads, patches of grass). Removing snow from grass or gravel patches that are away from the runways and taxiways can draw the flocks to these areas, creating less risk in the movement areas.

8.5 Gulls

Due to their large body size, flocking and flying behavior, gulls pose a significant threat to aircraft when present in the airport environment. Nationally from 1990-2013 gulls accounted for 7% of all bird strikes. Gulls are responsible for 11% of damaging strikes resulting in $53,464,710 in damages to civil aircraft (Dolbeer et al. 2014). At Boire Field, gulls accounted for 0% of strikes from 1990 to present resulting in no damage. During the WHA at Boire Field, three species of gulls where observed 43 times for a total of 98 individuals (Figures 26, 27). Gulls accounted for 1.5% of all bird observations and 1.2% of all individual birds observed during the WHA. Peak activity of gulls was observed during morning surveys (Figure 29). Gulls were commonly observed flying passing (57%), flying locally (36%), feeding (5%) and loafing (2%). These activities occurred in/on short grass (39%), runway (18%), asphalt/concrete (14%) and structures (7%) (Figure 28).

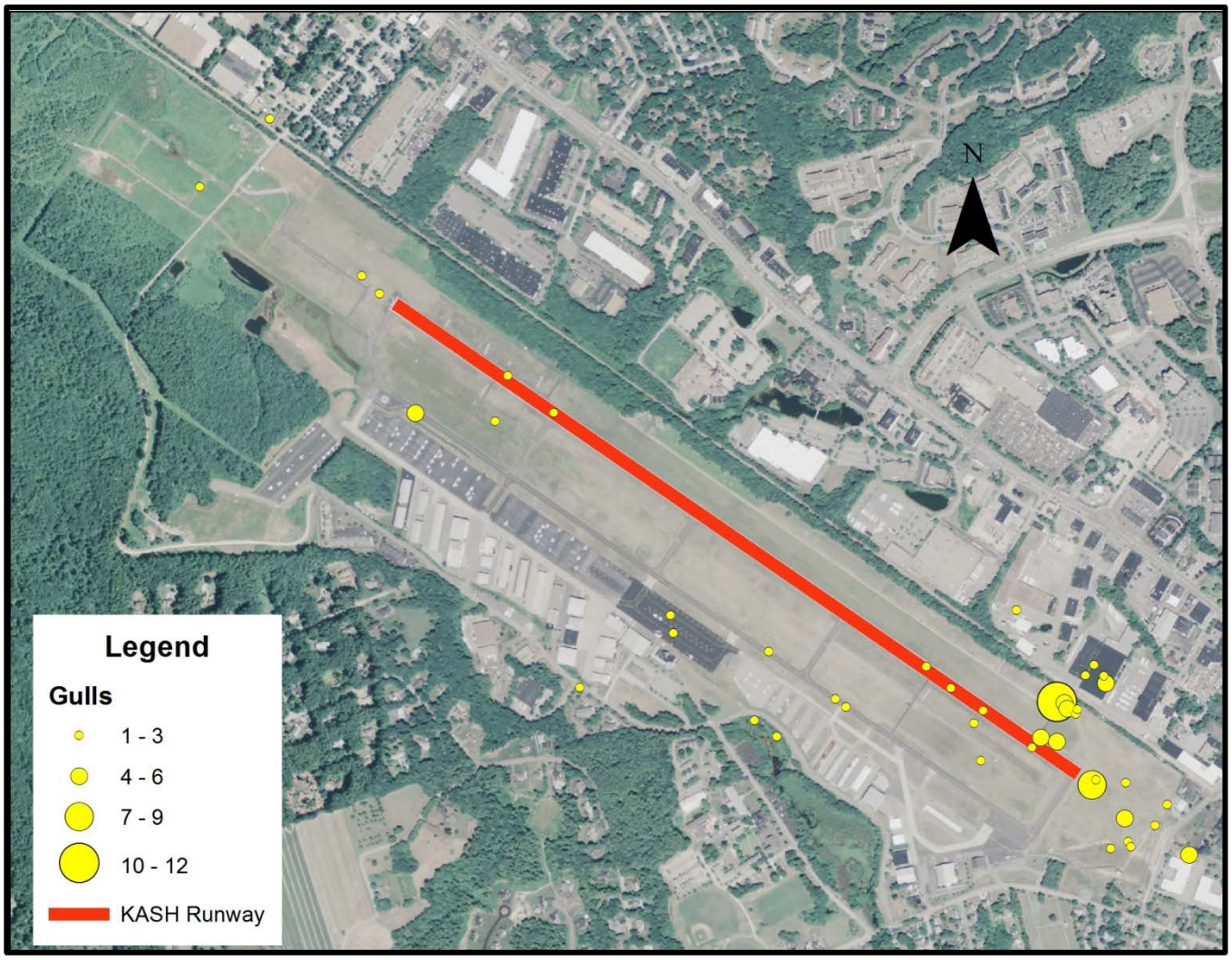


Figure 26. Gull locations during Boire Field's WHA from October 2013 through September 2014.

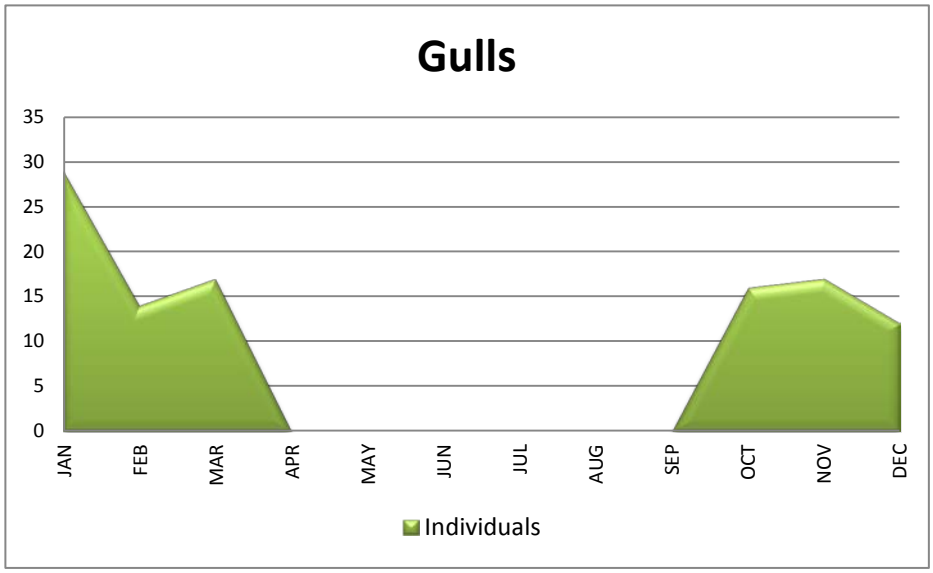


Figure 27. Gull abundance for Boire Field's WHA from October 2013 through September 2014. Gulls were only present on the airfield from October - March.

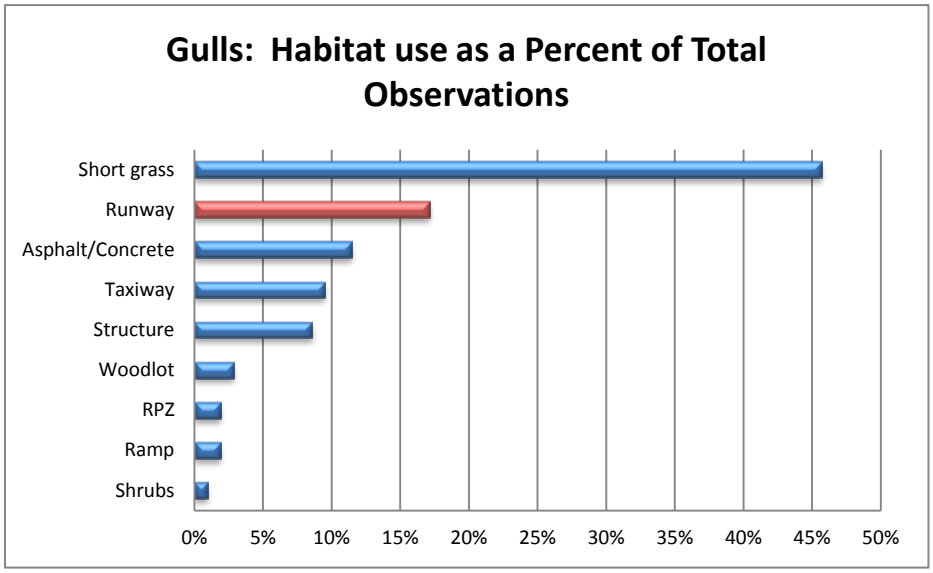


Figure 28. Gull use of habitat for Boire Field's WHA from October 2013 through September 2014.

Damage

Gulls are considered a primary hazard to aircraft due to their body size, abundance, expanding geographical range, flocking behavior, relatively slow flight characteristics and general tendency to concentrate at airports, particularly during inclement weather. Members of this bird family are responsible for 22% of all reported damaging strikes when the species of bird is known (Dolbeer et al. 2014). Gulls typically utilize airports for loafing and feeding areas, especially during weather events to

feed on earthworms or insects. The presence of gulls in or on the AOA should be considered a direct threat to human health and safety and should be harassed or removed immediately.

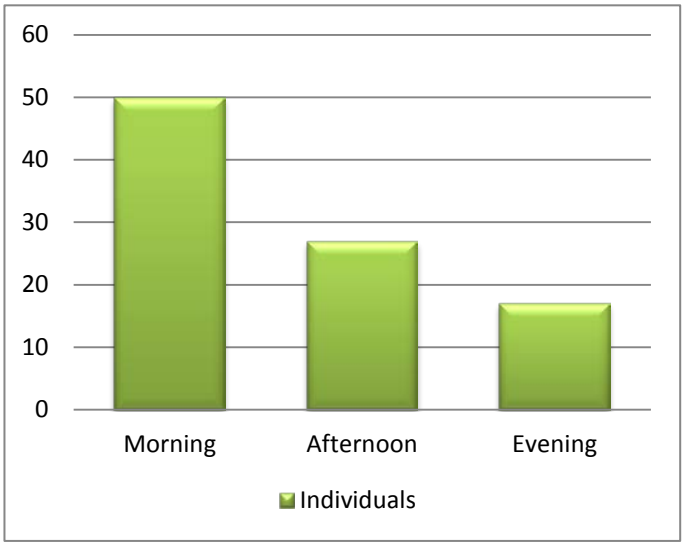


Figure 29. Gull abundance during each survey period for Boire Field's WHA from October 2013 through September 2014.

Legal Status

Gulls are classified as migratory birds and may be taken with a USFWS Migratory Bird Depredation Permit. A permit is not required to haze or harass gulls.

Control Measures

In a non-coastal environment, such as Boire Field, gulls should be actively excluded from the airfield through pro-active management and habitat modifications. Managing habitat to make it less attractive to gulls is the most effective control method. Containing trash, prompt removal of animal carcasses from the airfield, elimination of standing water and prevention of food handouts will usually deter gulls if combined with an active hazing and shooting program. However, gulls quickly habituate to hazing techniques (pyrotechnics, bioacoustics and visual scare devices) and individuals may need to be lethally removed to reinforce non-lethal methods. The efficacy of shooting as a removal technique has been conclusively demonstrated to lessen bird strikes at John F. Kennedy Airport in New York City while not impacting overall populations (Dolbeer and Bucknall 1997). Managing off site attractants near the airfield can also be helpful in reducing or eliminating gull activity on and around the airfield. Offsite attractants like landfills, transfer stations and waste management facilities can cause gulls to fly over the airfield as they move from one location to another. Working with local land owners and property managers to minimize gull activity on these sites has been shown to greatly reduce gull activity on local airfields.

8.6 Passerines (songbirds)

Passerines, including swallows, were the most abundant guild observed during the WHA at Boire Field. Due to the small size of these birds, many strikes may go unnoticed and unreported. Passerines usually pose little risk of damage to an aircraft; however, their behavior of flying locally around the airfield makes them frequently susceptible to being struck by aircraft. Nationally, Passerines accounted for 10.4% of all bird strikes and 1.9% of those strikes resulted in $4,808,625 in damages to civil aircraft from 1990 through 2013 (Dolbeer et al. 2014). At Boire Field, Passerines accounted for 7% of strikes reported from 1990 to the present resulting in no damages. During the WHA, 66 species of Passerines were observed 1,376 times totaling 2,266 individuals (Figures 30, 31). This accounts for 47.9% of bird survey observations and 25% of individual birds counted during the WHA. Peak activity of Passerines was observed during morning and afternoon surveys (Figure 33). Passerines were commonly observed vocalizing (66%), perching (17%), feeding (6%) and flying locally (5%). These activities occurred over/on woodlots (50%), shrubs (17%), short grass (11%) and fence (6%) (Figure 32).

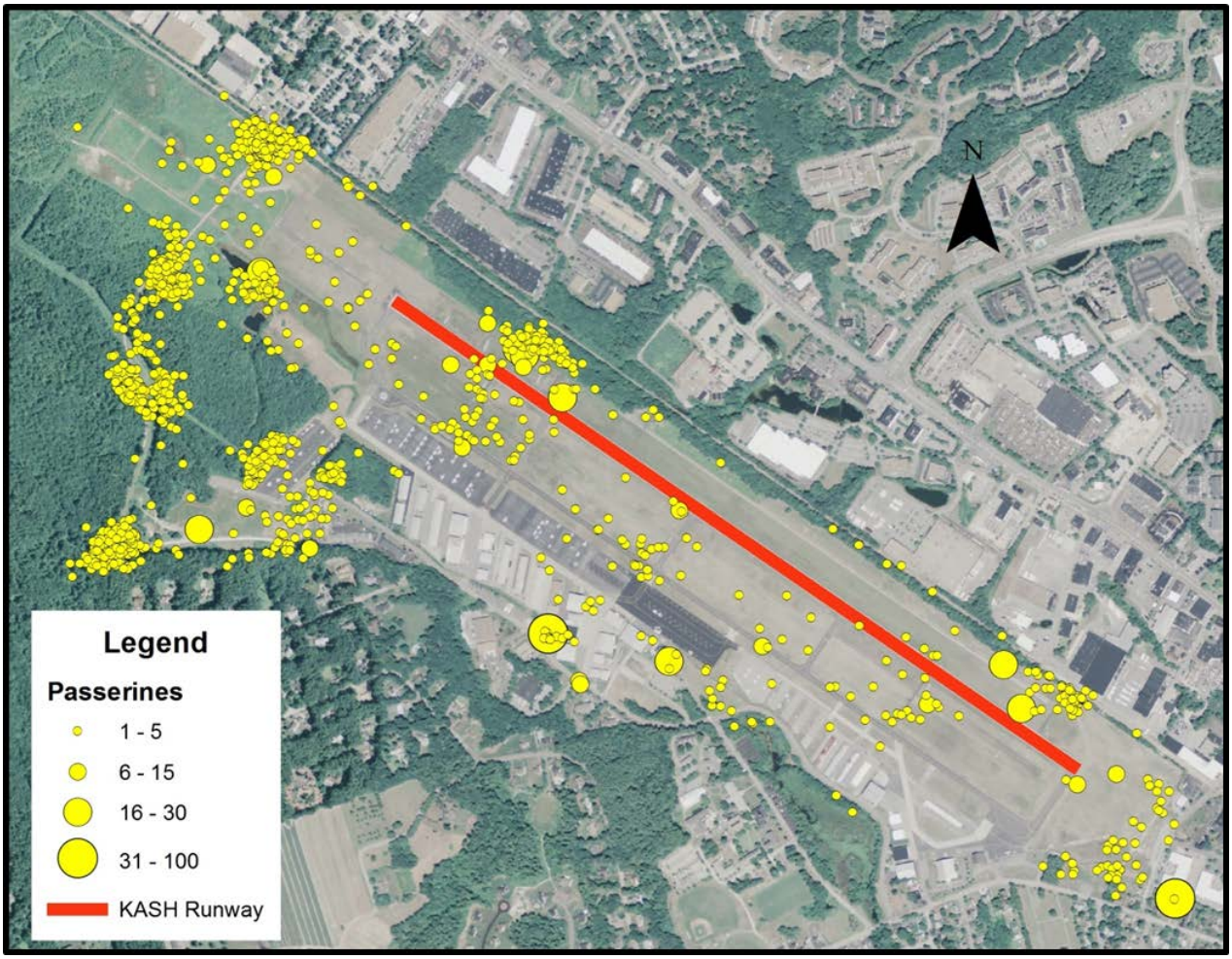


Figure 30. Passerine locations during Boire Field's WHA from October 2013 through September.

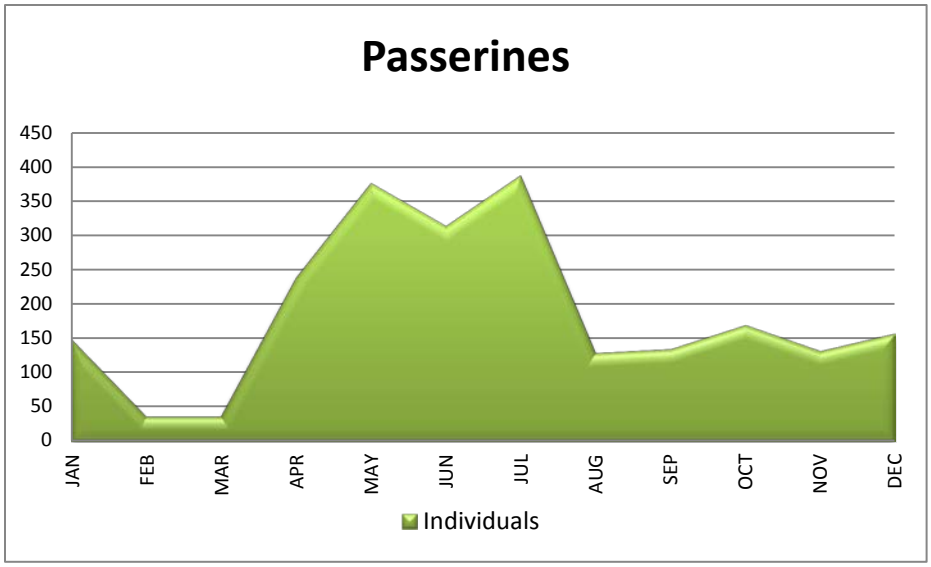


Figure 31. Passerine abundance for Boire Field's WHA from October 2013 through September 2014. The highest abundance of Passerines occurred in summer months, specifically July.

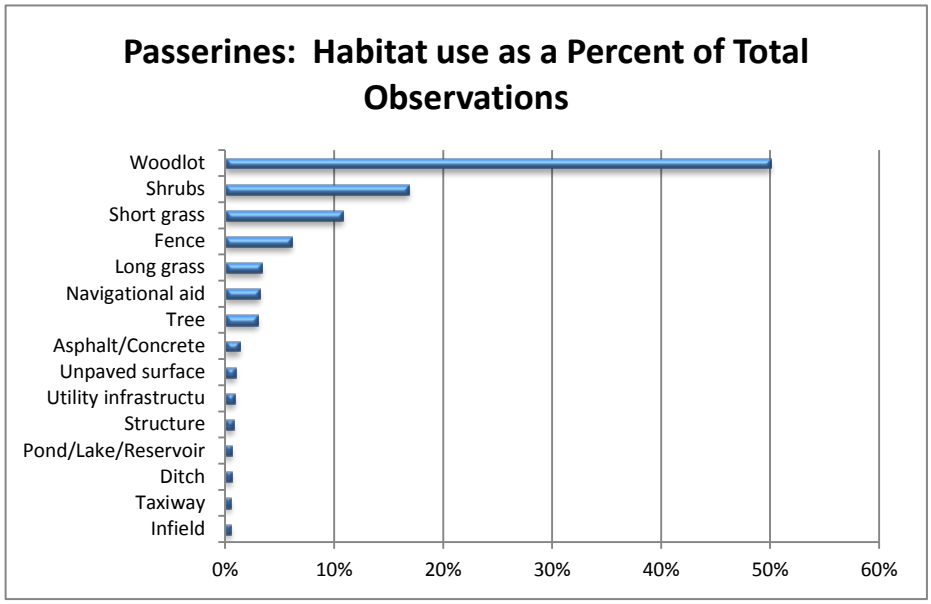


Figure 32. Passerine use of habitat during Boire Field's WHA from October 2013 through September 2014.

Legal Status

House sparrows are an introduced species and do not receive any legal protection. However, all other species characterized as "small perching birds" are protected under the MBTA and can be controlled with a USFWS Migratory Bird Depredation Permit.

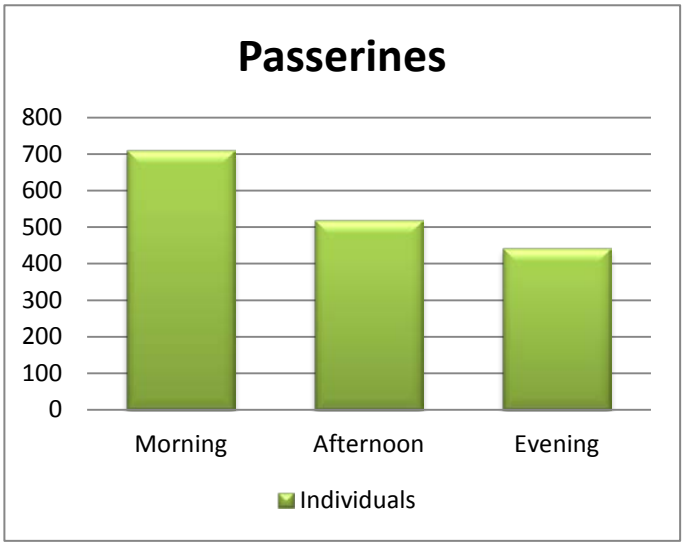


Figure 33. Passerine abundance during each survey period for Boire Field's WHA from October 2013 through September 2014.

Control Measures

Vegetation management on the airfield will reduce grass seed production, thereby, reducing forage availability by Passerines. Management of tall grass and the removal of brush piles, unwanted structures and weeds will reduce the presence of these species. Areas with bare ground should be re-vegetated to decrease habitat appeal. Grassy areas should be mowed prior to seed heads production. Pyrotechnics combined with visual repellents and periodic shooting can be used to disperse flocks from runways. Pyrotechnics are effective at immediately hazing birds from loafing on airport surfaces such as the runways; however, the birds may not move far and their movement can be unpredictable. Habitat management combined with periodic lethal removal is the most effective means of reducing the population of this species on and around the AOA. Exclusion netting can also be employed to prevent birds from accessing buildings, especially those with exposed rafters, as well as to keep birds from nesting in jet ways. Engine covers will prevent birds from nesting in idle aircraft engines.

8.7 Raptors (hawks, eagles, falcons, owls and vultures)

Raptors are predatory birds that feed upon small prey species. Raptors represent a significant strike risk to aircraft due to their large body size and their hunting and flying behavior, typically which involves flying of the airfield in turn increasing the possibility of interaction with aircraft. Nationally, Raptors accounted for 8.1% of all bird strikes from 1990-2013. When damage to aircraft in factored in, Raptors accounted for 11.4% of damaging strikes resulting in $104,100,846 in damages (Dolbeer et al. 2014). At Boire Field, Raptors accounted for 7% of strikes from 1990 to the present with no reported damages. During the WHA at Boire Field, 8 species of raptors where observed on 142 occasions totaling 184 individuals (Figures 34, 35). This accounts for 5% of bird survey observations and 2% of individual birds counted during the WHA. Peak activity of raptors was observed during afternoon and evening surveys (Figure 37). Raptors were commonly observed perching (53%), flying locally (18%), flying passing (11%) and towering (11%). These activities occurred over/on navigational aids (42%), woodlots (18%), short grass (14%) and long grass (6%) (Figure 36).

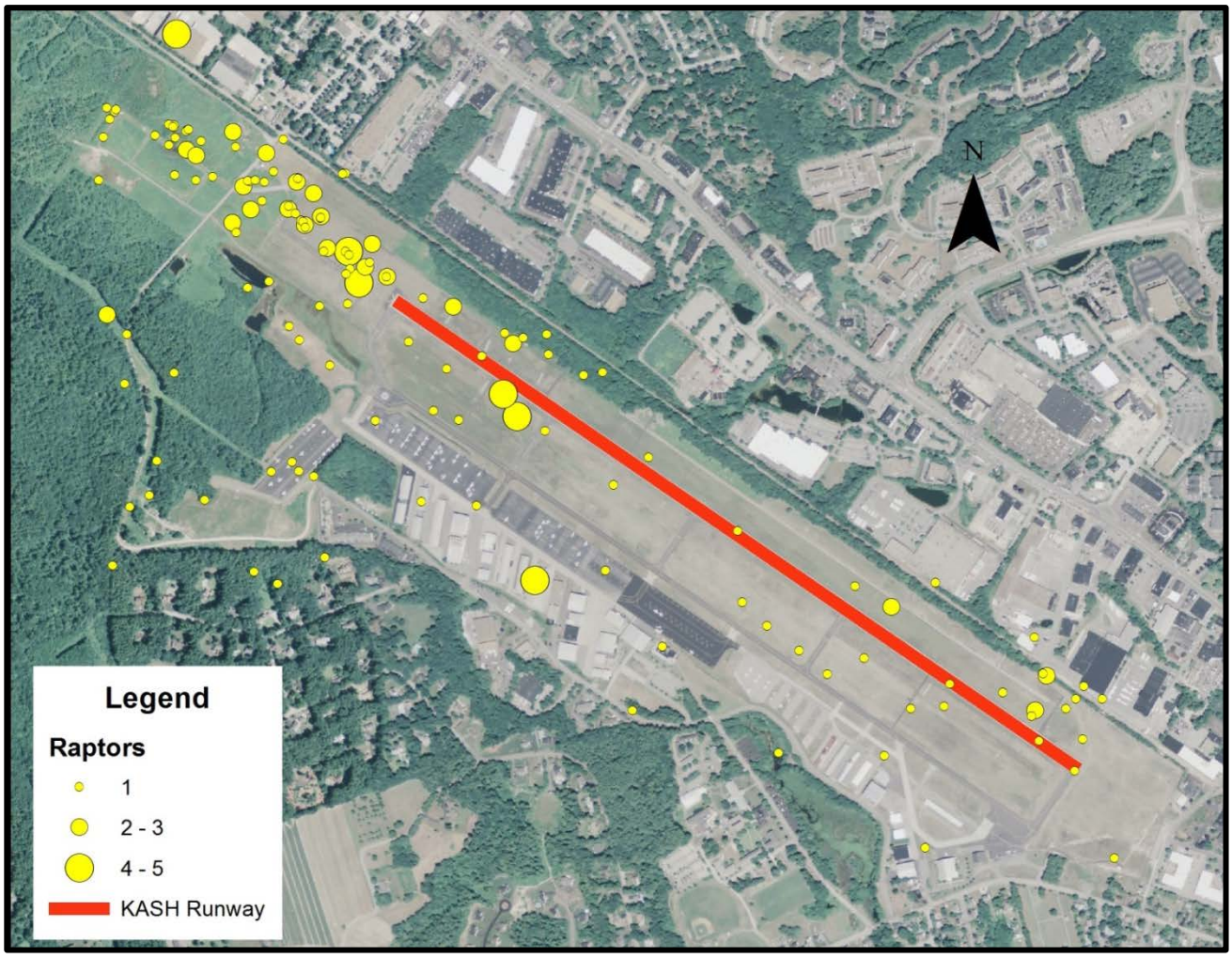


Figure 34. Raptor locations during Boire Field's WHA from October 2013 through September 2014.

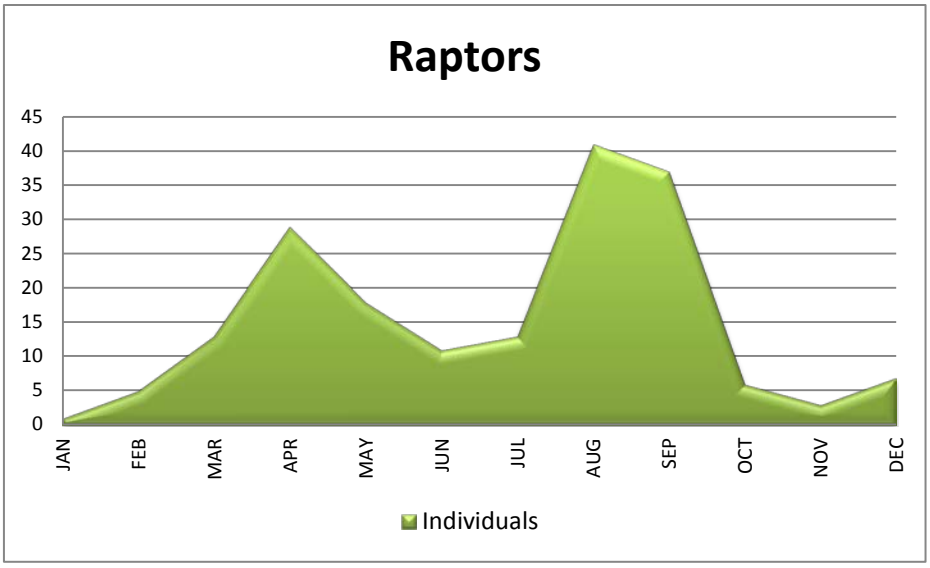


Figure 35. Raptor abundance for Boire Field's WHA from October 2013 through September 2014. The highest abundance of raptors occurred in spring, late summer and early fall.

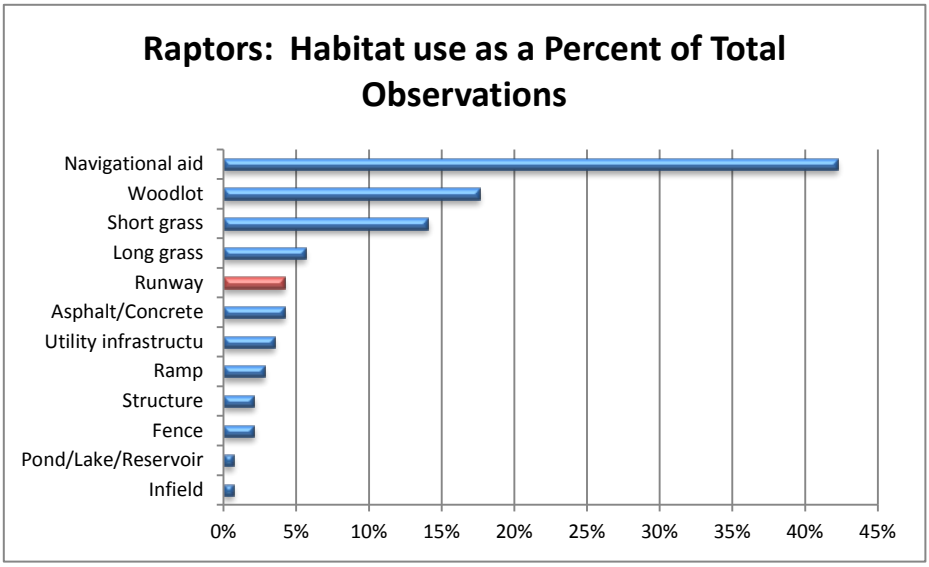


Figure 36. Raptor use of habitat during Boire Field's WHA from October 2013 through September 2014.

Damage

Raptors represent a significant hazard to aircraft since they are typically large in size, and their hunting behavior predisposes them to collisions with aircraft. Nationally, raptors account for 22% of known species bird-aircraft strikes that result in damage in the U.S. (Dolbeer et al. 2014). Hawks and owls are more commonly struck on airports while hunting, whereas vultures tend to be struck while soaring at higher altitudes. Two species in this guild have had a marked population increases in the past few decades. The red-tailed hawk population has increased annually at a 3% rate and the turkey vulture population has increased annually at a rate of 1% (Sauer et al. 2004).

Legal Status

All raptors and vultures are protected as migratory birds and may only be killed, trapped or relocated with a USFWS Migratory Bird Depredation Permit. Bald and Golden eagles are afforded additional protection under both federal and state regulations. It is illegal to possess either of these birds, alive or dead, in whole or in part (including eggs and nests). A permit must first be obtained from the USFWS to haze/harass eagles (USFWS prohibits the use of lethal control).

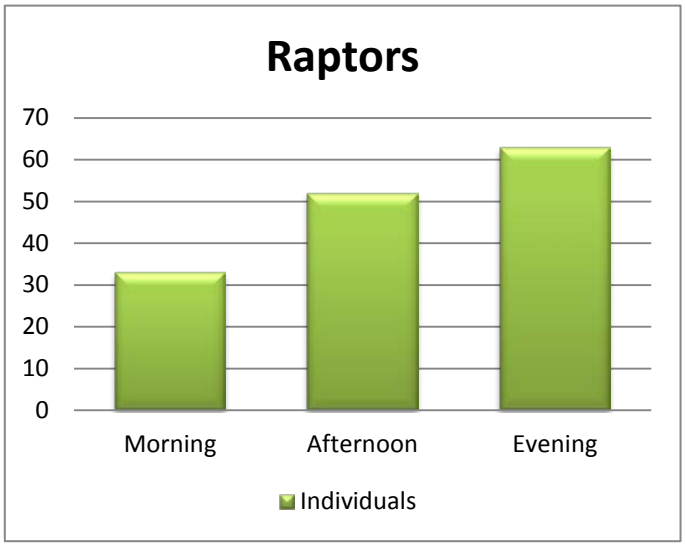


Figure 37. Raptor abundance during each survey period for Boire Field's WHA from October 2013 through September 2014.

In New Hampshire, Golden eagles and Northern harriers are listed as endangered species and Bald eagles and Peregrine falcons are listed as threatened species (Appendix I). Regulating agencies should be consulted prior to implementing any control action that may affect these species. The list of protected species in New Hampshire should be reviewed annually due to the possibility of a species status changing. An updated list can be obtained from the USFWS or the NHFG.

Control Measures

Raptors may be best managed through in integrated program including habitat modification, perching structure removal and exclusion, rodent/insect control or relocation. Perch sites, such as solitary trees and navigational aids, have a substantial effect on the ability of raptors to hunt, and should be removed or excluded to deter use. Grass should be managed for uniform composition, density and a height between 7 – 10 inches. Raptors that remain on the airfield can be hazed and dispersed using pyrotechnics (eagles require a permit to haze/harass). Non-respondent individuals may have to be trapped/relocated or lethally removed after all other methods have been unsuccessful (current eagle depredation permits restrict the use of lethal control for Bald and Golden eagles). If stated on the Federal permit, raptors can be captured by WS using several styles of traps including bal-chatri, padded-jaw leg hold, and Swedish goshawk. These traps are designed to relocate specific individuals. It may become necessary to lethally remove certain offending individuals if they pose a significant risk to air traffic. A U.S. Fish and Wildlife Service Migratory Bird Depredation Permit is required to handle or lethally remove any non-endangered or threatened raptor.

8.8 Upland Birds (turkeys, woodcock, ruffed grouse)

Nationally, upland birds accounted for 0.2% of all bird strikes from 1990-2013, and 0.5% of those strikes resulted in $1,193,968 in damages to civil aircraft (Dolbeer et al. 2014). At Boire Field, upland birds accounted for 0% of strikes from 1990 to the present with no reported damages. During the WHA at Boire Field, 3 species of upland birds were observed on 34 occasions totaling 130 individuals (Figures 38, 39). Wild turkeys were the most commonly observed bird of this guild identified during the WHA. This accounts for 1.9% of bird survey observations and 1.4% of individual birds counted during the WHA. Peak activity of Upland birds was observed during morning and evening surveys (Figure 41). Upland birds were commonly observed feeding (62%), standing (18%), loafing (6%) and running (6%). These activities occurred over/on long grass (56%), short grass (29%), woodlot (6%) and asphalt/concrete (6%) (Figure 40).

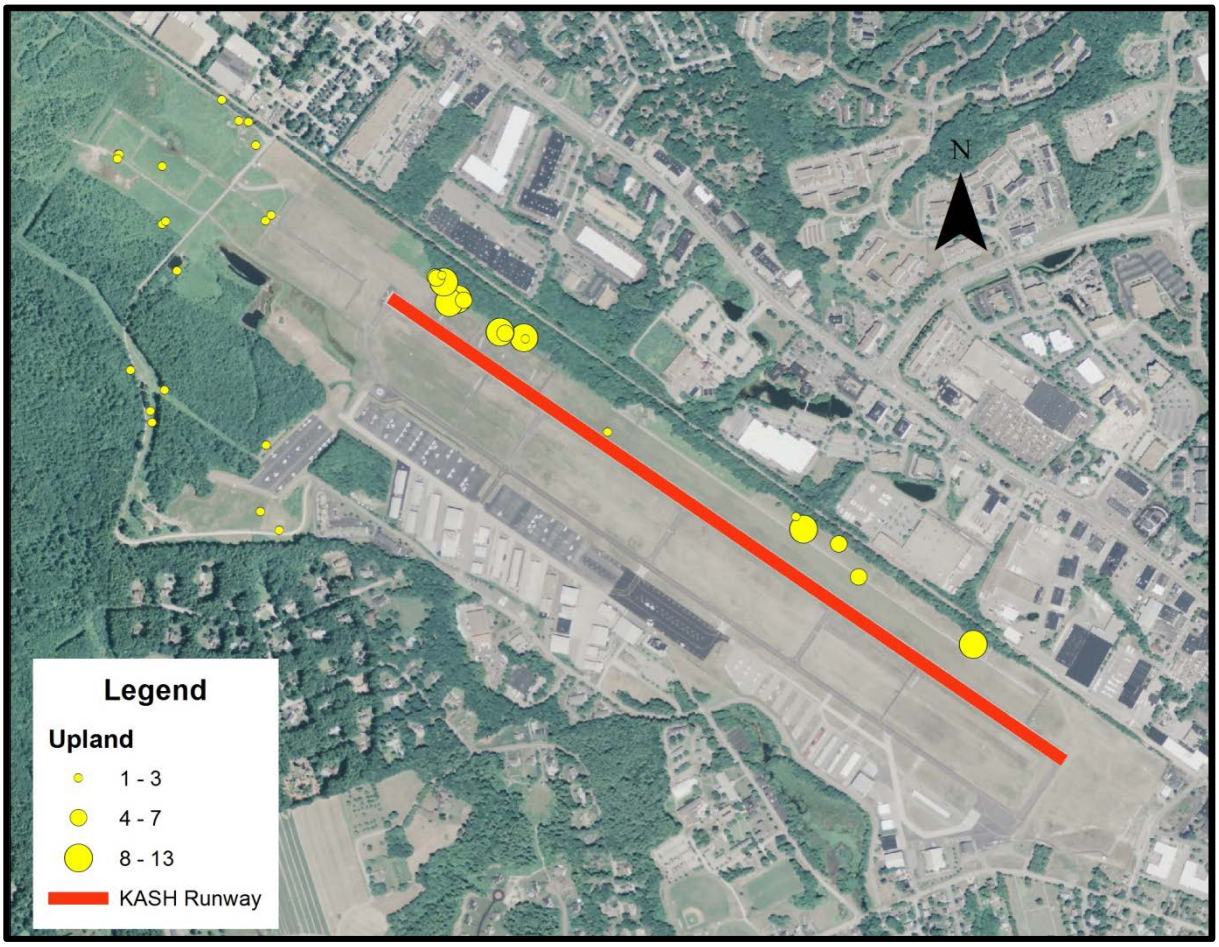


Figure 38. Upland bird locations during Boire Field's WHA from October 2013 through September 2014.

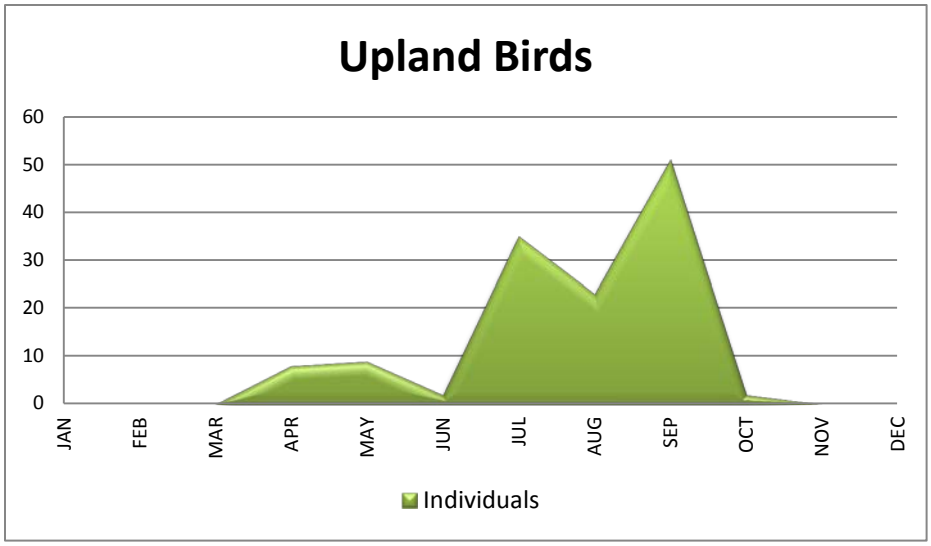


Figure 39. Upland bird abundance for Boire Field's WHA from October 2013 through September 2014. The highest abundance of upland birds occurred from July through September.

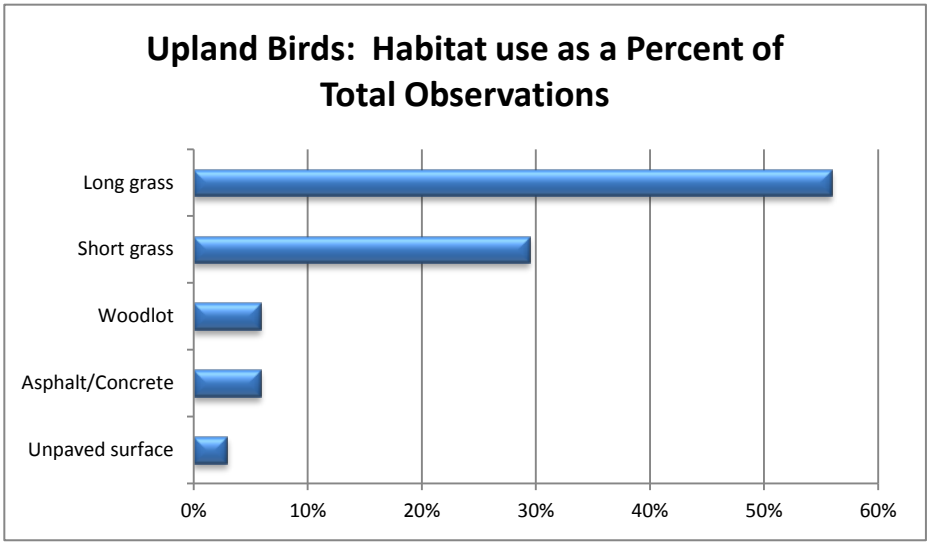


Figure 40. Upland birds use of habitat for Boire Field's WHA from October 2013 through September 2014.

Damage

Upland birds account for a miniscule percentage of reported bird strikes. For example, only 65 strikes involving turkeys were reported from 1990 to 2013 (Dolbeer et al. 2014). However, wild turkeys large body size and feeding habitats present an increased risk of damaging strikes as illustrated in 2003 when a KC-135E struck a turkey during landing roll at the Portsmouth International Airport at Pease causing $3 million worth of damage to the aircraft. The presence of wild turkeys on the airfield should be considered an immediate threat to human health and safety and turkeys should be harassed or lethally removed when discovered.

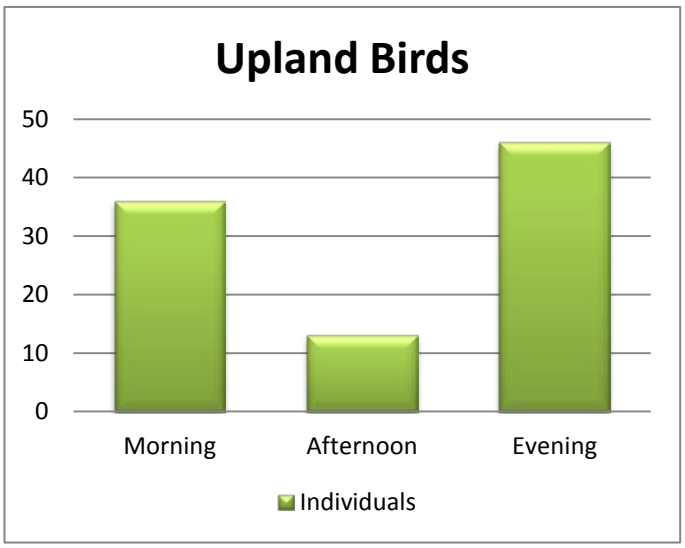


Figure 41. Upland birds abundance during each survey period for Boire Field's WHA from October 2013 through September 2014.

Legal Status

Turkeys are considered non-migratory game birds, and are regulated by the NHFG. There are currently two turkey seasons in NH, one in spring and one in fall. The spring season typically runs through the month of May while the fall season usually runs from mid-September through mid-December depending on location and method of take. Wild turkeys that present a hazard to the airport can be taken under the NHFG special permit (Appendix D) or by licensed hunter during the legal harvest season if allowed by Boire Field Management.

Control Measures

Habitat modification and harassment are effective in reducing wild turkey activity. Removing trees and brushy areas on the airfield and creating a vegetation-free buffer zone around the security fence will make the airport less attractive to turkeys. Wild turkeys can also be harassed with pyrotechnics or lethally removed with a shotgun under NHFG permit or during the legal harvest season by licensed hunter if approved by Boire Field Management.

8.9 **Wading and Shore Birds** (herons, sandpipers, killdeer, cormorants)

Nationally, Wading and Shorebirds accounted for 5.2% of all bird strikes from 1990-2013, and 2.8% of strikes when damage was reported resulted in $24,215,049 in damages to civil aircraft (Dolbeer et al. 2014). At Boire Field, Upland birds accounted for 7% of strikes from 1990 to the present with no reported damages. During the WHA at Boire Field, 9 species of wading and shorebirds were observed on 326 occasions totaling 806 individuals. Killdeer was the most commonly observed bird of this guild identified during the WHA (Figures 42, 43). This accounts for 11.3% of bird survey observations and 8.9% of individual birds counted during the WHA. Peak activity of wading and shorebirds was observed during morning and evening surveys (Figure 45). Wading and shorebirds were commonly observed standing (71%), feeding (12%), vocalizing (6%) and loafing (5%). These activities occurred over/on short grass (62%), asphalt/concrete (11%), long grass (8%) and taxiways (5%) (Figure 44).

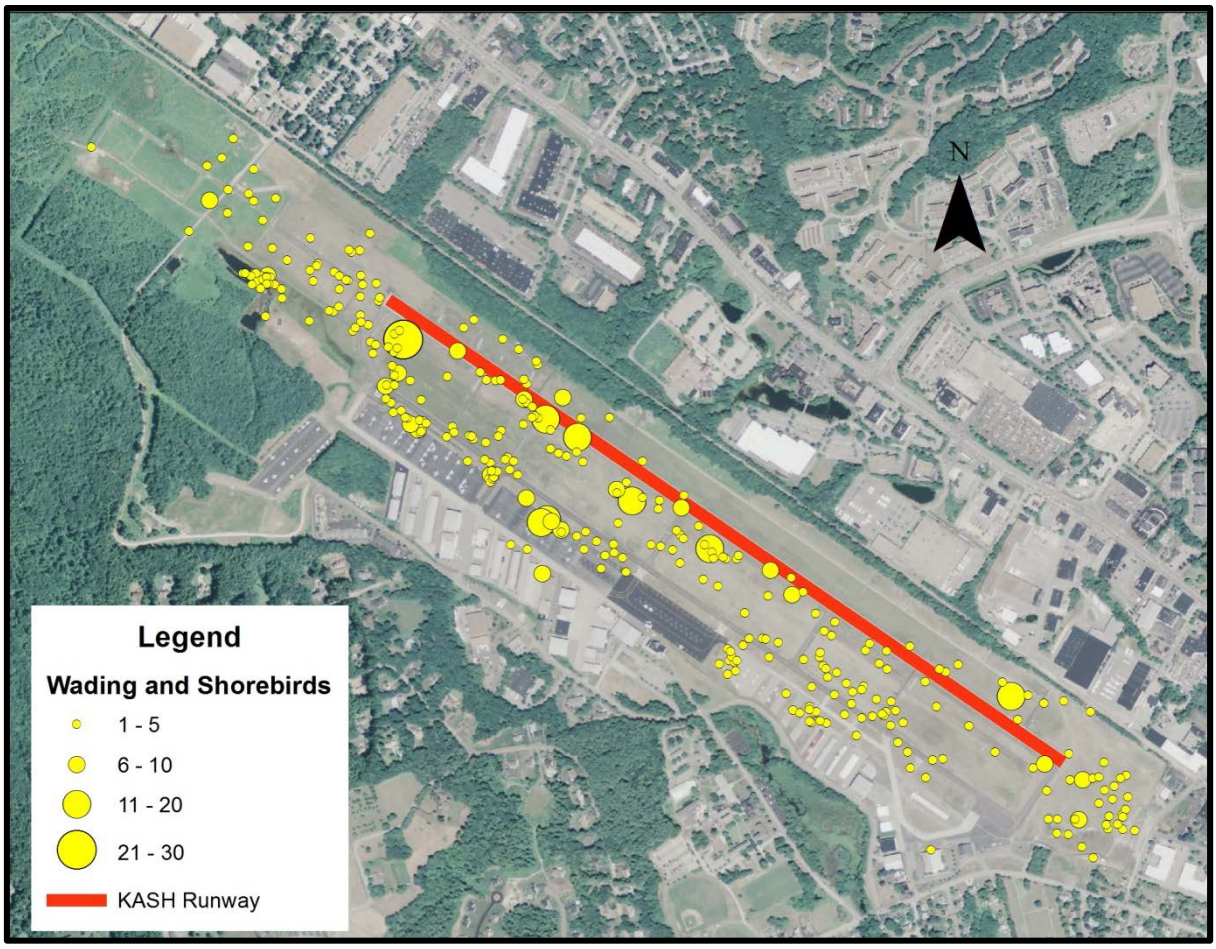


Figure 42. Wading and Shorebird locations during Boire Field's WHA from October 2013 through September 2014.

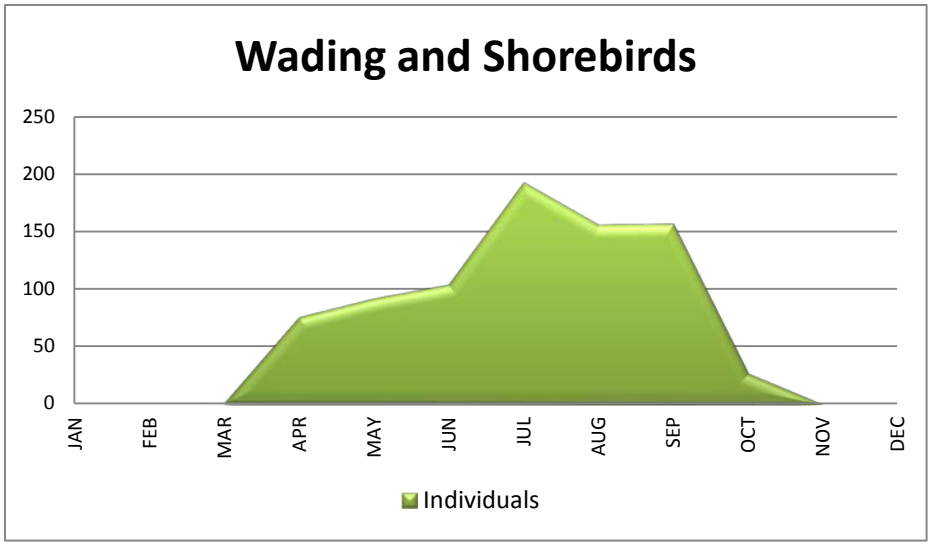


Figure 43. Wading and Shorebird abundance for Boire Field's WHA from October 2013 through September 2014. The highest abundance of wading and shorebirds occurred from spring to fall months.

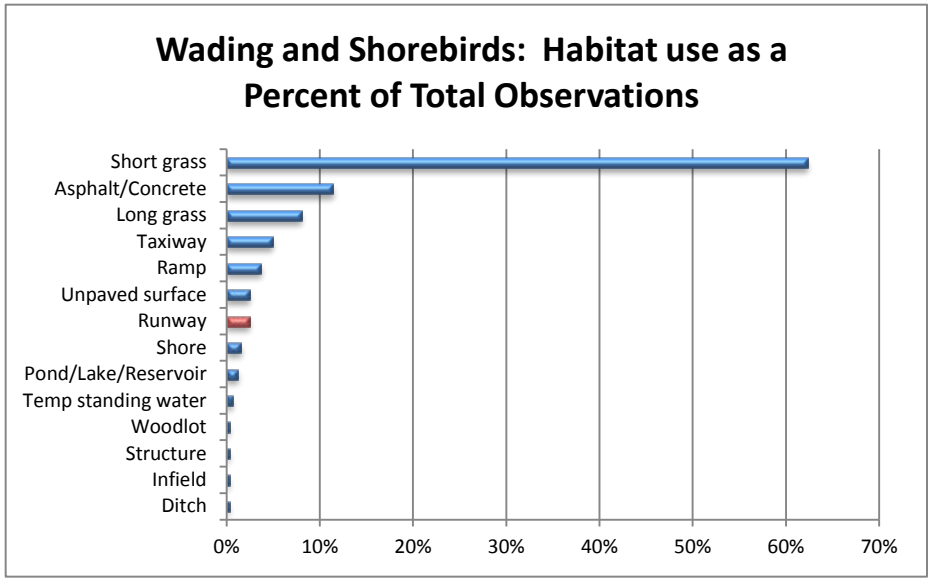


Figure 44. Wading and Shorebird use of habitat for Boire Field's WHA from October 2013 through September 2014.

Damage

Of the 25 most hazardous wildlife species to aircraft (egrets were not ranked), herons are ranked eleventh and smaller shorebirds such as killdeer and common snipes are ranked nineteenth (Cleary et al. 2005). Egrets and herons pose a greater threat to aircraft than smaller shorebirds. These long-legged, wading birds are much larger and can cause greater impact damage to aircraft. They are

also slower and more lumbering in flight than the smaller birds. The smaller birds tend to nest close to where they feed and they forage and travel along shorelines. The larger birds may travel farther, in comparison, between foraging areas and their roost, crossing various types of terrain including runways.

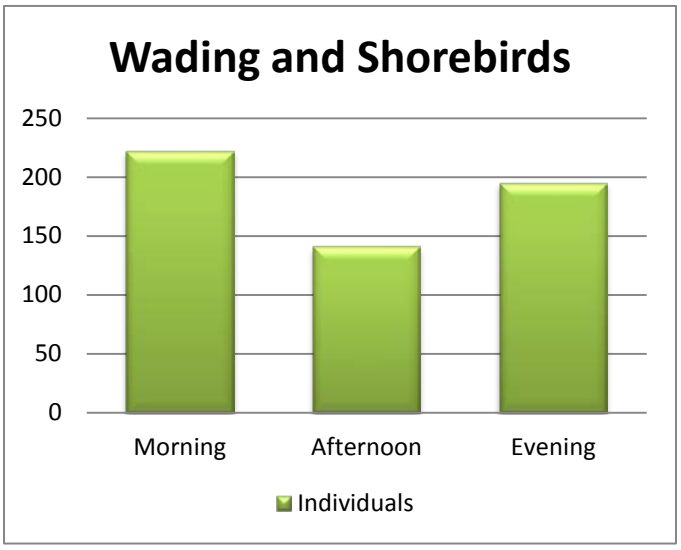


Figure 45. Wading and Shorebird abundance during each survey period for Boire Field's WHA from October 2013 through September 2014.

Legal Status

Wading and Shorebirds are classified as migratory nongame birds and are protected under the Migratory Bird Treaty Act. They may be lethally removed with a USFWS Migratory Bird Depredation Permit.

Control Measures

Management for these birds can be difficult. Wading birds and shorebirds are attracted to wetlands which are often found adjacent to or on airports. The manipulation or modification of wetlands is regulated. If drainage ditches are on the airport, they should be kept free of aquatic vegetation and tall grass. Standing water should be drained from ditches to reduce attractiveness to wading birds. Egrets and herons should be deterred from crossing the airport by hazing them with pyrotechnics. Hazing with pyrotechnics should also occur if these birds are observed foraging, roosting or loafing on the airport. It may be necessary to take one or two individuals that persist on the airfield. Lethal removal requires a USFWS Migratory Bird Depredation Permit.

8.10 Waterfowl (Ducks, Geese, Brant and Swans)

Waterfowl are particularly hazardous to aircraft due to their size, weight, body density and flocking behavior. The emergency landing of U.S. Airways Flight 1549 in New York's Hudson River in January 2009 dramatically demonstrated to the public the serious nature of waterfowl/aircraft strikes. Nationally, waterfowl species accounted for 3.2% of all bird strikes from 1990-2013, and 14.8% of strikes when damage was reported resulted in $216,768,401 in damages to civil aircraft (Dolbeer et al. 2014). At Boire Field, waterfowl accounted for 14% of strikes from 1990 to the present with $28,500 in damages reported. During the WHA at Boire Field, 3 species of waterfowl were observed on 77 occasions totaling 591 individuals (Figures 46, 47). This accounts for 2.7% of bird survey observations and 6.5% of individual birds counted during the WHA. Canada geese and mallards were the most prevalent species and accounted for 64% and 36% of total waterfowl observation, respectively. Peak activity of waterfowl was observed during morning and evening surveys (Figure 49). Waterfowl were commonly observed flying passing (57%), loafing (23%), feeding (6%) and standing (5%). These activities occurred over/on short grass (35%), pond/lake/reservoir (21%), woodlot (19%) and runway (8%) (Figure 48).

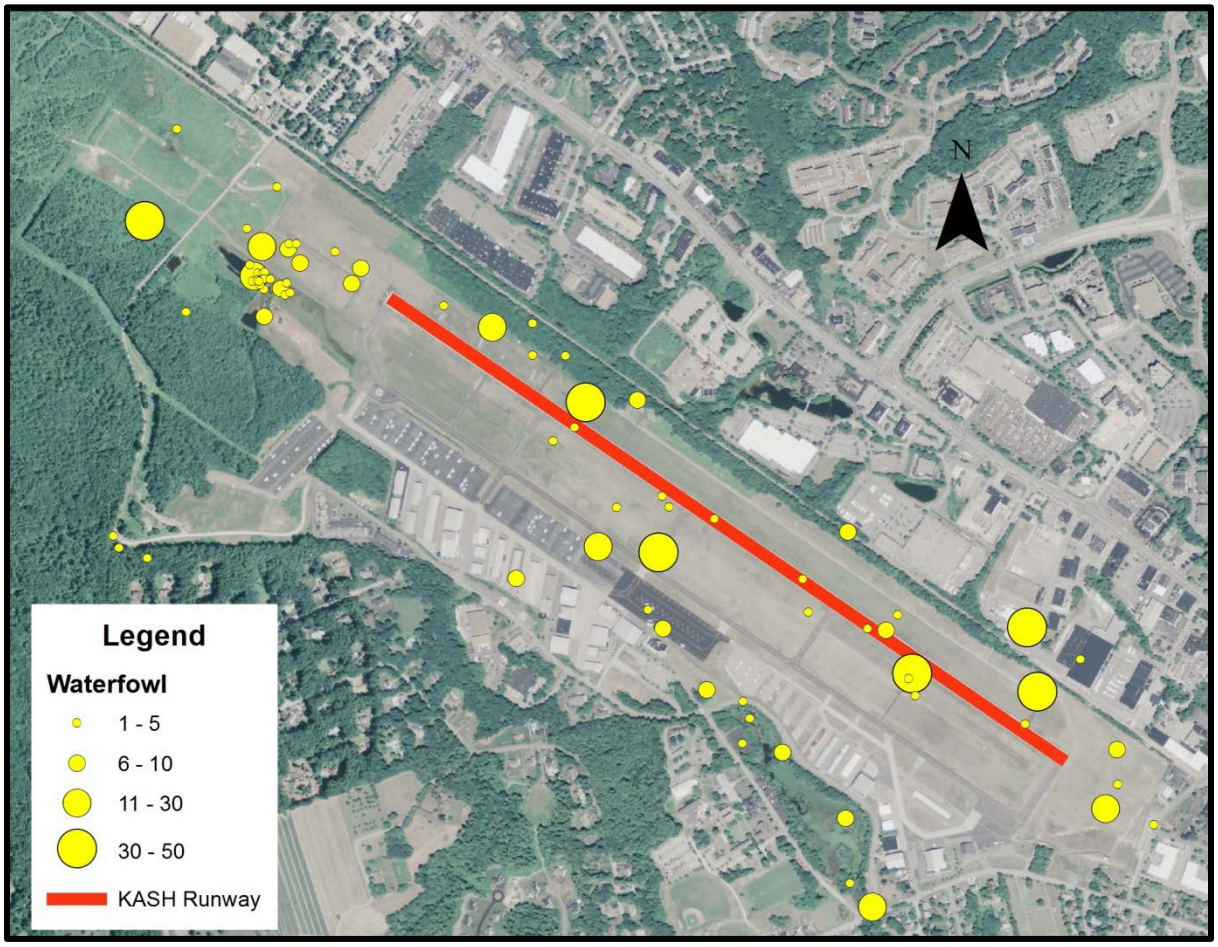


Figure 46. Waterfowl locations during Boire Field's WHA from October 2013 through September 2014.

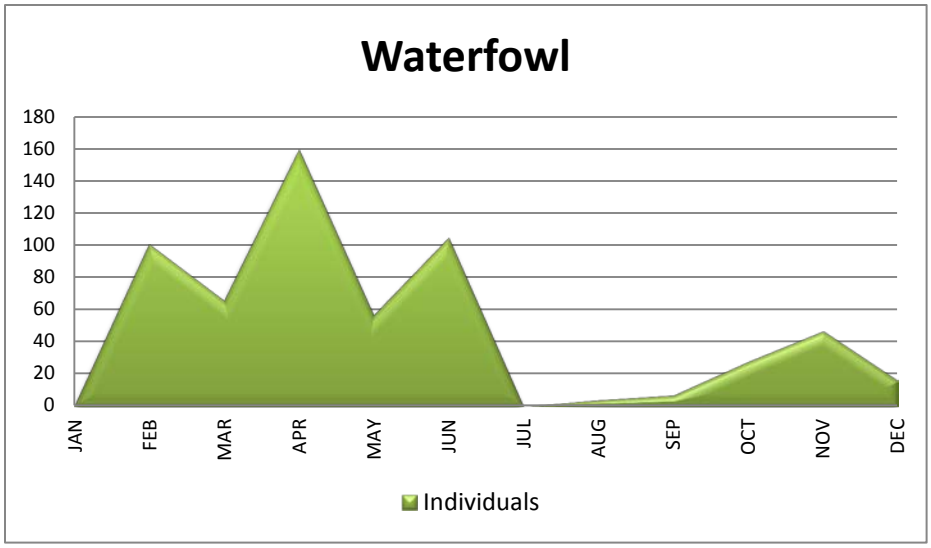


Figure 47. Waterfowl abundance for Boire Field's WHA from October 2013 through September 2014. The months of highest waterfowl abundance at Boire Field was in February, April and June.

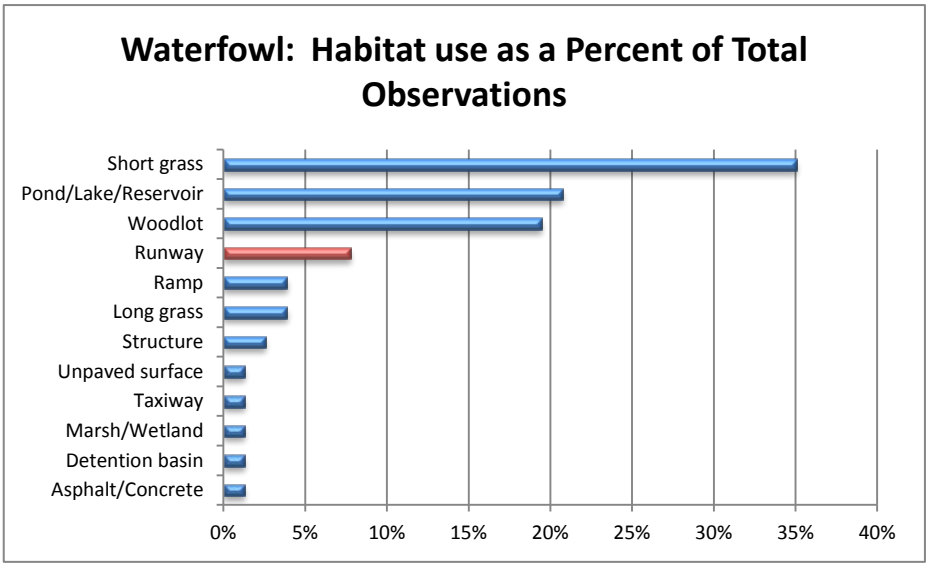


Figure 48. Waterfowl use of habitat for Boire Field's WHA from October 2013 through September 2014.

Damage

Waterfowl can be particularly hazardous to aircraft because of their large size, weight, flocking behavior, and relative abundance. Nationally, waterfowl represent 6.3% of known species bird-aircraft strikes in the U.S. (Dolbeer et al. 2014). Canada geese and mallards rank ninth and seventeenth, respectively, out of the top 30 bird species reported as struck and causing damage by civil aircraft in the U.S. between 1990 and 2013 (Dolbeer et al. 2014). Geese are ranked first among all species groups for

being the most costly species for an aircraft to strike (Dolbeer et al. 2000). The potential for damage by Canada geese was tragically illustrated in September 1995 when an Air Force AWACS plane crashed in Alaska after striking a flock of Canada geese on takeoff, killing all 24 crew members.

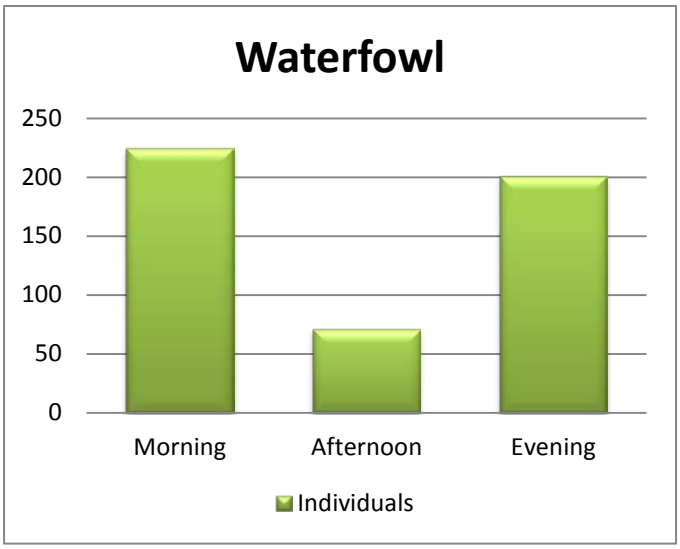


Figure 49. Waterfowl abundance during each survey period for Boire Field's WHA from October 2013 through September 2014.

Legal Status

Bird species in this category are migratory and are protected under the MBTA. Waterfowl may be hunted during the fall and winter, during the legal harvest season. There are constraints that limit the feasibility of hunting as a viable control technique for urban Canada geese, including seasonal restrictions, bag limits and municipal ordinances. If lethal control is required out of the regulated hunting season, the species must first be listed on the Federal Migratory Bird Depredation permit. Airport personnel may also register with the USFWS to perform nest and egg destruction for Canada geese from March 1-June 1 by going to (https://epermits.fws.gov/eRCGR/geSI.aspx?ReturnUrl=%2feRCGR. A permit is not needed to haze waterfowl with pyrotechnics.

Control Measures

An important aspect of managing Canada geese and other waterfowl is to prevent them from feeling safe in the airport environment. It is imperative that waterfowl are harassed as soon as they arrive, until it is certain that they have left and not merely moved to another area on the airport. One of the best methods to control waterfowl is the removal or exclusion of ponds, ditches and wetland habitats. Exclusion may be another option in areas where frequent activity is observed and pond removal is not feasible. Wire grids are effective at 10 -20 ft. intervals (for most species) over ponds and wetlands. Mylar tape stretched between two stakes, 50-100 feet apart at 25-foot intervals may be temporarily effective for feeding areas. Exclusion methods should also be used to prevent waterfowl from accessing storm water detention ponds when water is present for long periods after rainfall. Usually long grass management (7-14 in.) or an unpalatable ground cover can effectively preclude a wide variety of waterfowl from feeding on airfields. Pyrotechnics work well for most waterfowl, especially during hunting seasons. If birds become tolerant of hazing efforts, it may become necessary to lethally remove a few individuals to reinforce these methods. Habituation to hazing techniques is most often noticeable with resident Canada geese, but may also occur in migrants a few weeks after the regular hunting season closes. Waterfowl are also affected by the use of visual repellents in conjunction with pyrotechnics. An aggressive approach must be taken to keeping waterfowl off the airfield if they begin to feed or loaf on the property. In addition to implementing direct control actions, airport

personnel responsible for managing wildlife hazards and pilots should be made aware of potential hazards, especially during the fall and spring migration periods when waterfowl are plentiful.

8.11 Mammals (coyotes, foxes, rabbits, raccoons, opossums and deer)

From 1990 through 2013, 3,149 terrestrial mammal strikes resulting in damaging 917 civil aircraft totaling $58,110,148 in the United States (Dolbeer et al. 2014). At Boire Field, one mammal strike involving a white-tailed deer has been reported to the National Wildlife Strike Database (NWSD) from 1990 to the present resulting in $5,500 in damages. During the WHA, 14 species were observed 77 times totaling 90 individuals (Figures 50, 51). White-tailed deer were the most commonly observed (n=27), followed by woodchucks (n=15) and skunks (n=8). Feral cats (n=6); red fox, coyote and beaver (n=3 each); opossum, muskrat, grey squirrel, grey fox and chipmunk (n=2 each); raccoon and black bear (n=1 each) were also observed during the WHA. Mammals were commonly observed in short grass (40%), long grass (21%), shrubs (9%) and on asphalt/concrete (8%). The highest seasonal and daily mammal abundances occurred in summer and fall months (Figure 51) and during nocturnal surveys (Figure 52).

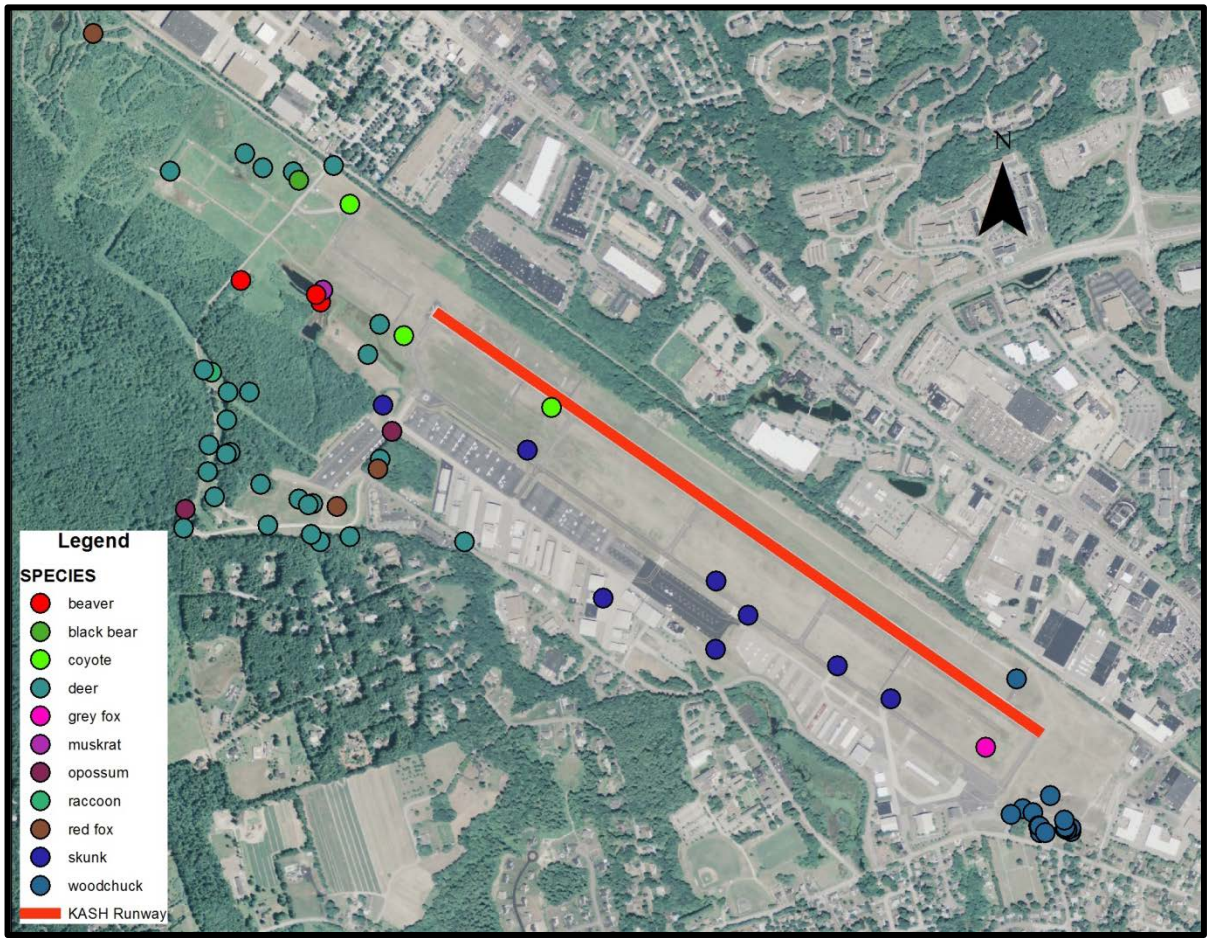


Figure 50. Mammal locations during Boire Field's WHA from October 2013 through September 2014.

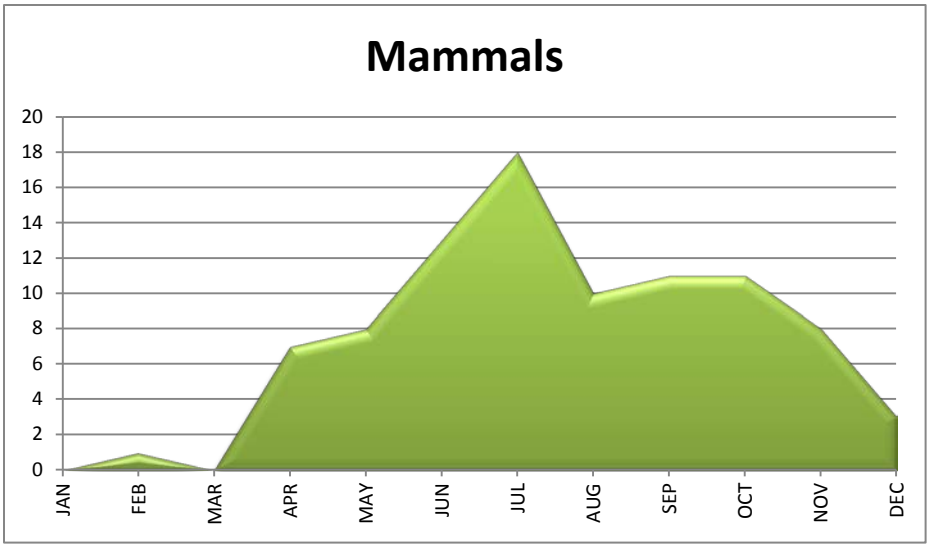


Figure 51. Monthly mammal abundance at Boire Field from October 2013 through September 2014.

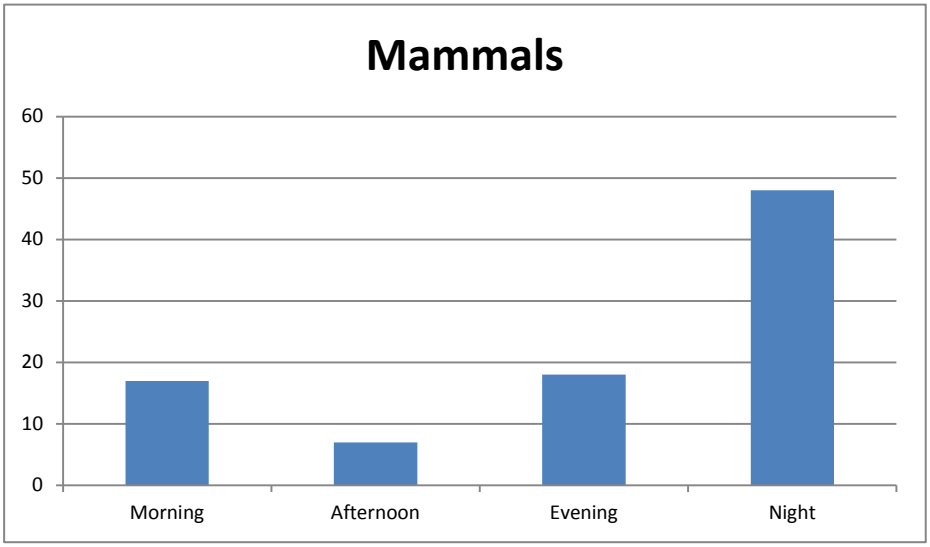


Figure 52. Mammal abundance during each survey period for Boire Field's WHA from October 2013 through September 2014.

Mammal Observations

The mammal of greatest concern at Boire Field is the white-tailed deer due to the number of animals observed on the airfield (37) during the WHA, and their large body size. Nationally, from 1990-2013, white-tailed deer have been reported struck 978 times resulting in 238,058 hours of aircraft downtime and totaling $43,888,843 in damages (Dolbeer et al. 2014). Coyotes are also a concern at

Boire Field. They were seen five (n=5) times on the airfield during both spotlight and afternoon point count surveys. Nationally, over the past 20 years, coyotes have been reported struck 443 times resulting in $3,667,729 in damage (Dolbeer et al. 2014). Both red (n=3) and grey foxes (n=2) were observed by WS during the WHA, indicating fox are utilizing the airfield, presumably hunting for small mammals. Finally, one black bear was observed outside the perimeter fence in the shrubby field near the runway 14 approach light system travelling through the grass. Other mammal species observed include the striped skunk, raccoon, muskrat, opossum and beaver.

White-tailed deer (*Odocoileus virginianus*)

Deer were frequently observed inside and outside the perimeter fence during the WHA. WS biologists documented deer activity on the airfield during spotlight surveys and bird surveys. From 1990 to present, one white-tailed deer strike has been reported at Boire Field, resulting in $5,500 in damage. During the WHA, deer were observed on 27 occasions totaling 37 individuals (Figure 53). Observations of deer were primarily in the northwestern and western portions of the airport. Specifically the field adjacent to India ramp, along the perimeter fence bordering Deerwood Drive, in the woodlot between India ramp and Deerwood Drive and in the field surrounding the Runway 14 approach light system outside the perimeter fence. Deer were either living in the woodlot or passing through the perimeter fence to gain access to the airfield. Gaps under the fence line in these areas reach up to 12”, a height that would easily allow deer to access the airport.

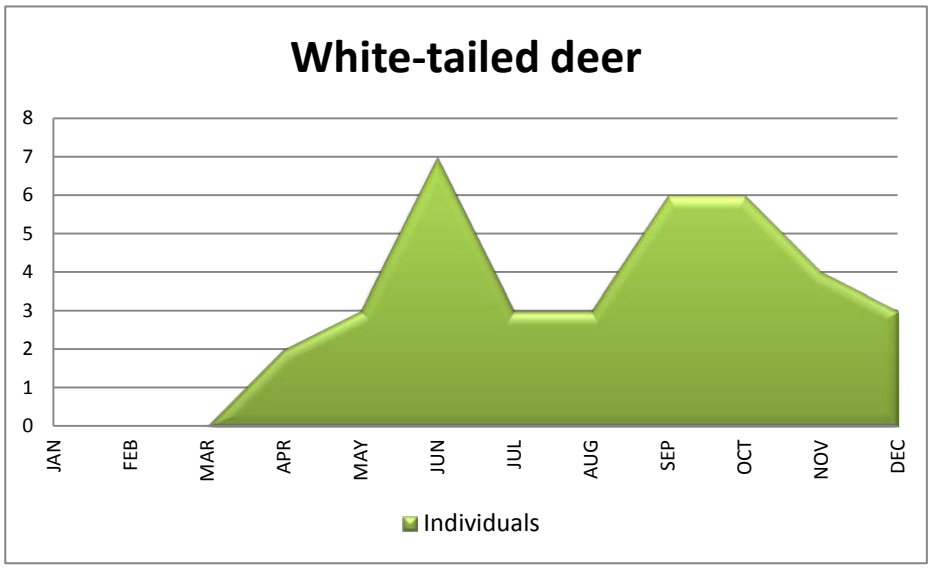


Figure 53. Monthly white-tailed deer abundance at Boire Field from October 2013 through September 2014. Deer activity was highest in June, September and October.

Damage

Despite their economic and aesthetic values, deer also have a variety of negative impacts. They destroy agricultural crops and landscaping plants. They are also implicated in human health and safety issues including auto collisions, aircraft collisions, Lyme Disease and Foot and Mouth Disease. The white-tailed deer population in the United States has increased from a low of about 350,000 in 1900 to about 24 million in 1994 (Jacobson and Kroll 1994). The deer population in NH is estimated at 100,000 and 13,269 in Wildlife Management Unit (WMU) M, in which Boire Field is located. Deer density or deer per square mile of habitat is 24.85 in WMU M (Dan Bergeron, personal communication, NHFG December 2014).

FAA Cert Alert No. 01-01, "Deer Aircraft Hazard", was issued in February 2001 after a Learjet owned by the Dallas Cowboys struck two deer at the Troy, Alabama airport while landing and was destroyed in the resulting crash and fire. The Cert Alert reminded airport operators of the importance of controlling deer on and around airfields and to offer suggestions to resolve deer hazards to aircraft.

Nationally, white-tailed deer account for 31% of all mammal aircraft strikes and 80% of all mammal strikes involving damage (Dolbeer et al. 2014). Deer rank first as the most hazardous animal to aircraft (Cleary et al. 2005) because they do more damage when struck by a plane than any other animal. Deer are dangerous because they will dart in front of an aircraft at the last minute. It is often smaller aircraft that incur the most damage, including total destruction of the plane and possibly death of crew and passengers.

Legal Status

Deer are a resident game animal and are regulated by the state. However, they may be taken out of season under a NHFG Special Permit. This allows the permittee and any person employed by or acting under authorization of the permittee to kill nuisance wildlife as stipulated in the permit. This permit will stipulate species, manner of take, carcass disposal, documentation of activities and may include special conditions pertaining to individual airports. White-tailed deer may also be hunted by a licensed hunter during the legal harvest season.

Control Measures

The most effective long-term control measure for deer is exclusion. Exclusion is best accomplished by installing an 8-foot, or higher, chain link fence with 3-strand, barbed wire outriggers and a buried skirt completely enclosing the airport (Appendix G). The fence should be maintained vegetation free and each side should be regularly mowed, preferably to a width of 10 yards but at least the width of a mower deck. Fences can be modified or constructed with alternate materials to comply with wetland or FAA regulations. Tall brush and trees, which provide cover to deer, should be thinned out or removed. If a deer is found on the airfield, measures should be immediately taken to remove the animal lethally or non-lethally by herding the deer through an open gate. Deer can also be harassed

using pyrotechnics. Boire Field has a state issued permit to lethally remove deer discovered on the airfield. Boire Field also allows regulated hunting during the deer hunting season. WS recommends Boire Field continue employing the use of licensed hunters to aid in deer removal. The entire deer carcass should be removed or gut pile bagged and removed so as not to create a food attractant for other species of wildlife such as coyotes, foxes and vultures.

Coyote (*Canis latrans*)

During the WHA, coyotes were observed on three occasions totaling five individuals. Coyotes were observed during spotlight and afternoon bird surveys in short grass and infield areas. They were seen at the approach end of runway 14, near the access road to the runway 14 approach lights and in the infield area between the 14 Precision Approach Path Indicators (PAPIs) and taxiway Delta. Coyote use of the airfield was in habitat that provides hunting opportunities for small prey, specifically short grass, long grass and edge. The numerous gaps 6 inches and over in the perimeter fence allow coyotes to easily access the airfield.

Damage

Nationally, coyotes account for 14% of terrestrial mammal strikes totaling $3,667,729 in damage from 1990-2013 (Dolbeer et al. 2014). Coyotes are listed 16th as the most hazardous animal to aircraft based on the percentage of strikes causing damage to aircraft (Cleary et al. 2005). Because of the moderate size, coyotes can damage landing gear or other aircraft parts if struck during landing or take-off. Coyotes will commonly move throughout the AOA, crossing runways and taxiways as they access feeding areas. Coyotes also cause damage and create hazardous conditions by digging holes under the perimeter fence. If the habitat is conducive, coyotes will also den in the airport environment.

Legal Status

Coyotes are considered furbearers by the NHFG. In New Hampshire there is no closed season for hunting coyotes. A special night season takes place from January 1st to March 31st. Written landowner permission is required. Trapping season for coyotes runs from October 15th to March 31st, dates vary depending on location. Under RSA 207:26 airport personnel may take a coyote if the animal "is in the act of doing actual and substantial damage" or is a direct threat to human health and safety.

Control Measures

An integrated management approach including habitat modification, hazing and harassing, small rodent control, exclusion and lethal removal can reduce the coyote population in the airport environment. Exclusion and removal of coyotes are the typically the most effective methods to reduce risk. Zero non-lethal methods have been found that would reduce coyote numbers on airports. Coyotes are most easily taken by trapping. Experienced trappers must be used because coyotes that escape from traps become trap shy and are difficult to capture again. Boire Field can contact a state licensed nuisance wildlife control operator (WCO) or WS for trapping options. Coyotes can also be taken on an airport by shooting. Approaching coyotes by vehicle may be possible if the coyote is accustomed seeing certain vehicles that do not pose a threat to them. Once coyotes are established in an area, a program

to manage the population will have to be initiated. Like deer, coyotes can be kept from an area with a tall fence with barbed wire out riggers and buried skirt.

Many airport managers encourage the presence of coyotes with the intention of allowing a "natural control" for woodchucks, small mammals and wild turkeys. This type of management is not appropriate on an airport since it is likely that coyotes will become difficult to control and could result in a strike with an aircraft. The effectiveness of coyotes keeping prey populations under control is limited and not based on scientific data.

Removing shrubs, brush piles and debris will reduce cover and availability of small mammals that attract coyote to the airfield. Woodchucks can be shot or cage trapped and removed to limit their numbers.

Coyote on taxiway Alpha at Boire Field

Red Fox (*Vulpes vulpes*) and Gray Fox (*Urocyon cinereoargenteus*)

During the WHA, red foxes were observed on three occasions for a total of three individuals and grey foxes were observed on two occasions for a total of two individuals. Red foxes were observed at the edge of the woodlot east of India ramp, in the small field south of India ramp and outside the perimeter fence on the fire access road northwest of the airfield. Gray foxes were observed in the infield north of the 32 run-up area and in the grass located next to the 14 localizer shack. Fox sightings occurred in October, November, July and August; however fox likely utilize the airfield all year. As with coyotes, foxes utilized the numerous gaps in the perimeter fence and gates to access the airfield for hunting opportunities.

Damage

Nationally, from 1990-2013, both red and grey foxes accounted for 4.5% of all terrestrial mammals struck totaling $58,051 in damages (Dolbeer et al. 2014). Foxes will move throughout the AOA, crossing runways and taxiways, as they move between cover and hunting areas. Due to their moderate size, fox can cause damage to landing gear as well as other aircraft components when struck.

Legal Status

Red and gray foxes are furbearing animals and are regulated by New Hampshire State Law. Currently fox hunting season is from September 1st – March 31st and the trapping season is from October 15th – January 15th depending on location. Under RSA 207:26 airport personnel may take a red fox if the animal "is in the act of doing actual and substantial damage" or is a direct threat to human health and safety. Airports may trap fox outside of the normal trapping seasons by contacting a wildlife control operator or WS.

Control Measures

An integrated management approach including habitat modification, hazing and harassing, small rodent control, exclusion and lethal removal can reduce fox populations in the airport environment. Removing shrubs, brush piles and debris will reduce cover and availability of small mammals that attract foxes to the airfield. Woodchucks and squirrels can be shot or trapped and removed to limit their numbers and availability. Foxes adapt quickly to frightening devices such as propane cannons, tape recordings or pyrotechnics. These methods may be used to temporarily reduce fox activity in an area. Trapping can be an effective and selective control method and should be conducted by an experienced trapper. Unsuccessful attempts at trapping may serve to "educate" the fox making them more difficult to trap. Shooting is also an effective and selective method to remove fox. When shooting fox on an airport, safety is of paramount importance. Care should be taken that there is always an adequate backstop for the bullet.

9.0 Small Mammal Survey

A small mammal survey was conducted in the spring and fall of 2014 (May 19-22 and September 8-11). WS selected four plots that contained variations in vegetation type and density. This strategy increases the possibility of capturing multiple rodent species (Figure 54). At each plot 50 mouse sized snap traps were set for a total of 200. Traps were set and checked for three consecutive trap nights in both spring and fall surveys. During the surveys, 38 small mammals were captured on the airfield.

Of the small mammals trapped there were; twenty-two (22) deer mice (*Peromyscus maniculatus),* seven (7) meadow jumping mice (*Zapus hudsonius*), four (4) northern short-tailed shrews *(Blarina brevicauda)*, two (2) meadow voles (*Microtus pennsylvanicus*), two (2) white-footed mice (*Peromyscus leucopus*) and one (1) Eastern chipmunk (*Tamias striatus*) captured. Twenty-two (22) small mammals (58%) were captured at Plot 1 (Woodland) which was located in the woodland east of the 32 obstruction tower. Vegetation at this site consists primarily of mature oak, maple and birch trees. Ten (10) of the small mammals captured (29%) were in Plot 2 (long grass) which was located in the small field southeast of pond 3. Habitat primarily consists of tall grasses, small herbaceous shrubs and small trees. This area lies in between three water detention ponds.

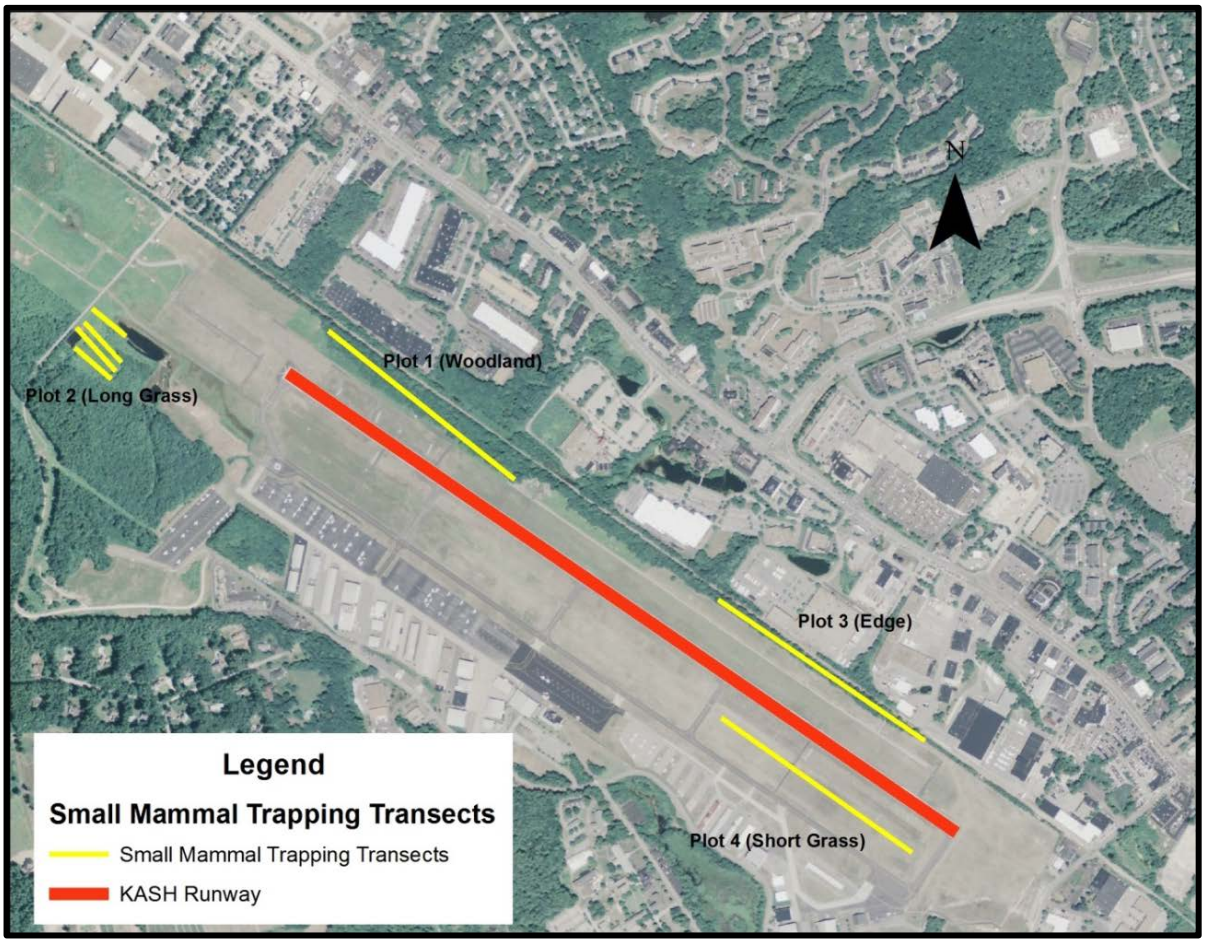


Figure 54. Locations of small mammal trapping transects during Boire Field's WHA.

Five (5) small mammals (24%) were captured in Plot 3 (edge) which was located north of the approach end of runway 32 on the edge of the wooded area along the fence. Habitat primarily consists of shrubs and softwood trees.

No small mammals were caught during either fall or spring trapping efforts at Plot 4 (short grass). This transect was located in the infield area from taxiway Bravo running southeast to taxiway Alpha. Vegetation consists of grasses and small herbaceous shrubs which was kept at a height of 4 to 6 inches. As expected, higher densities of small mammals were observed in Plots 1, 2 and 3. These areas provide cover and increase availability of food sources near wooded edges. Plot 4, which is located adjacent to runways or taxiways, had low densities of small mammals because of limited cover and scarce food resources provided from shorter grass in these areas.

Controlling small mammal populations on an airport is important because small mammals are a primary source of food for many larger avian and mammalian predators. High populations of small mammals can attract many of these larger predators that pose a threat to aviation safety. Capture data at Boire Field indicates a higher abundance of small mammals in Plots 1, 2 and 3. Vegetative composition in these three plots included tall grass, shrubs and wooded edges which provides cover for small mammals. Removing understory vegetation and clearing brush would eliminate cover and forage which in turn would help reduce local small mammal populations at Boire Field.

10.0 Offsite Hazards

Figure 55. Locations of offsite wildlife attractants monitored during Boire Field's WHA.

FAA Advisory Circular 150/5200-33B, "Hazardous Wildlife Attractants on or Near Airports" provides guidance on certain land uses that have the potential to attract hazardous wildlife on or near public use airports. Section 1 (1-3) recommends a separation distance of 10,000 feet from any hazardous wildlife attractant (section 2-4 and 2-7) for airports serving turbine-powered aircraft and section 1 (1-4) recommends a distance of 5 statute miles for the protection of approach, departure and circling airspace. In keeping with the separation criteria, WS selected 9 sites within a 5-mile radius of Boire Field to identify potential offsite wildlife hazards (Figure 55). These sites included Round Pond (1), Spectacle Brook (DWC Marsh) (2), Bertucci's Restaurant pond (3), Pennichuck Watershed at Manchester Street (4), Mine Falls Park at Soifert Playing Fields (5), Mill Pond (6), Boat Launch at Mine Falls Dam (7), Four Hills Landfill (8) and Horseshoe Pond Merrimack (9). For analysis purposes, Mill Pond and the Boat Launch at Mine Falls Dam were combined due to their close geographic proximity. It is important to note that various other wildlife hazards exist within Boire Field's 5-mile critical airspace. WS objective was to investigate wildlife activity at attractants in close proximity to the airfield, as well as accessible larger bodies of water.

Canada geese at Bertucci's Restaurant pond

10.1 Round Pond

Round pond is a small pond located 0.72 miles to the northwest of the runway 14 approach. Round Pond is located within a commercial zone and is surrounded by hardwood and coniferous trees, a scrub/shrub understory and manicured turf grass. During the WHA, gulls and other waterfowl were seen utilizing the pond. Ring-billed gulls were observed during 4 of the 17 surveys here from October 2013 through September 2014.

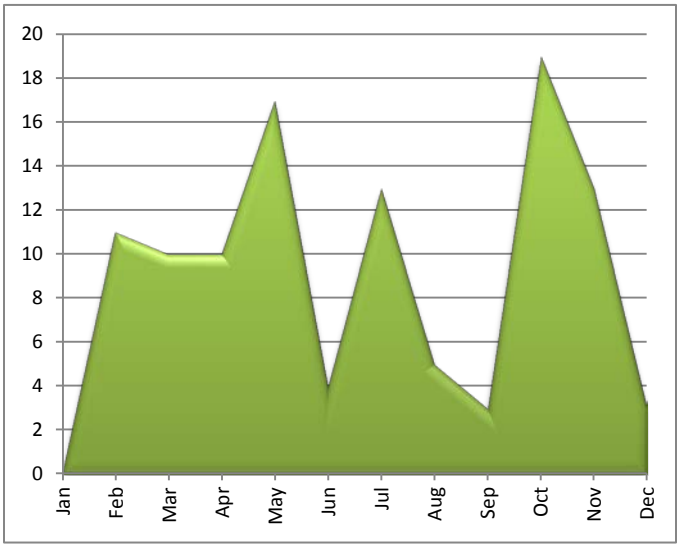


Figure 56. Monthly wildlife abundance at Round Pond from October 2013 through September 2014.

During the same time period, 25 wildlife species totaling 108 individuals were observed at Round Pond. Wildlife was observed throughout the year ranging from 19 individuals in October 2013 to a low of 3 individuals in September 2014 (Figure 56). Passerines, gulls, flocking birds, Corvids and waterfowl were the top 5 observed guilds at this location (Figure 57). The five most commonly observed species were ring-billed gulls (n=26), American crows and common grackles (n=11), American robins and black capped chickadees all (n=8).

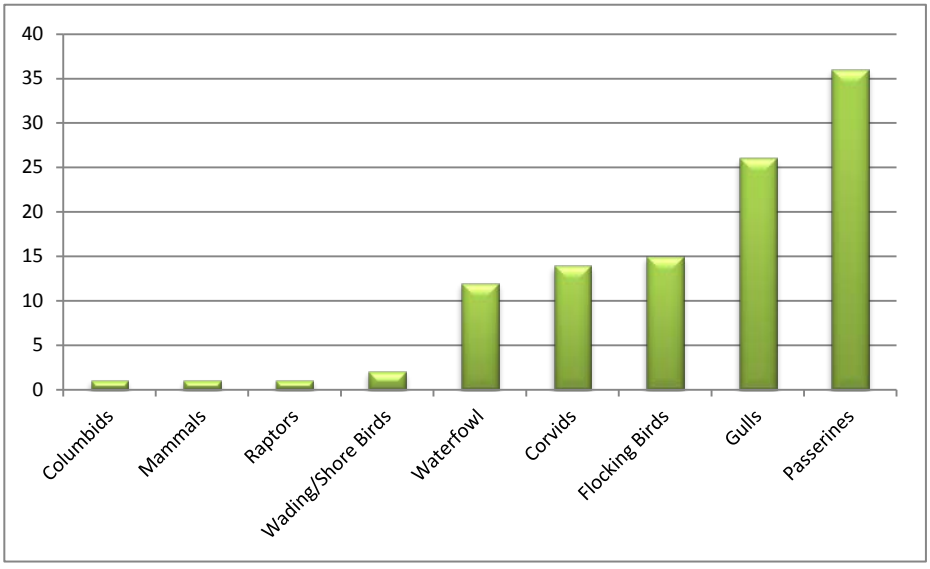


Figure 57. Abundance of birds and mammals by guild observed at Round Pond during Boire Field's WHA from October 2013 through September 2014.

10.2 Spectacle Brook (Daniel Webster College Marsh)

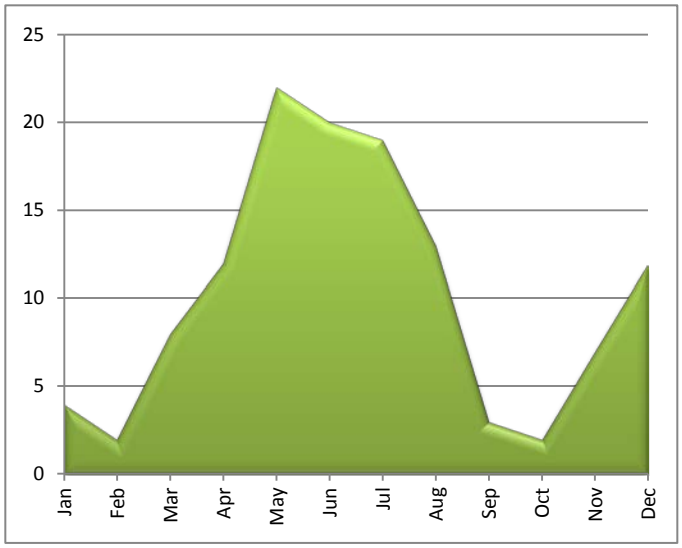


Figure 58. Monthly wildlife abundance at Daniel Webster College Marsh from October 2013 through September 2014.

Spectacle Brook (Daniel Webster College Marsh) is located on the southwest side of Boire Field toward the south end of the airfield, approximately 0.25 miles from the approach end of runway 32. This marshy wetland is tucked between developed airport property on the east and college academic buildings and recreational fields on the west. It is surrounded by a red maple and white pine overstory and shrubby understory. Waterfowl were seen in the marsh year-round because the marsh did not freeze in winter. Red-winged blackbirds were the most frequently observed species at this site, seen during 8 of the 17 surveys during the WHA. Of greatest concern, this site also served as a nesting area for a pair of Canada geese that were later seen foraging with their goslings on turf grass at the adjacent Daniel Webster College.

From October 2013 through September 2014, 25 wildlife species totaling 124 individuals were observed at Daniel Webster College Marsh. Wildlife was observed throughout the year ranging from a low of 2 individuals in October 2013 to a high of 22 individuals in May 2014 (Figure 58). Passerines, flocking birds, waterfowl, Columbids and Corvids were the top 5 observed guilds at this location (Figure 58). Red-winged blackbirds (n=22), mallards (n=17), mourning doves (n=11, American robins (n=10) and song sparrows (n=9) were the five most commonly observed species (Figure 59).

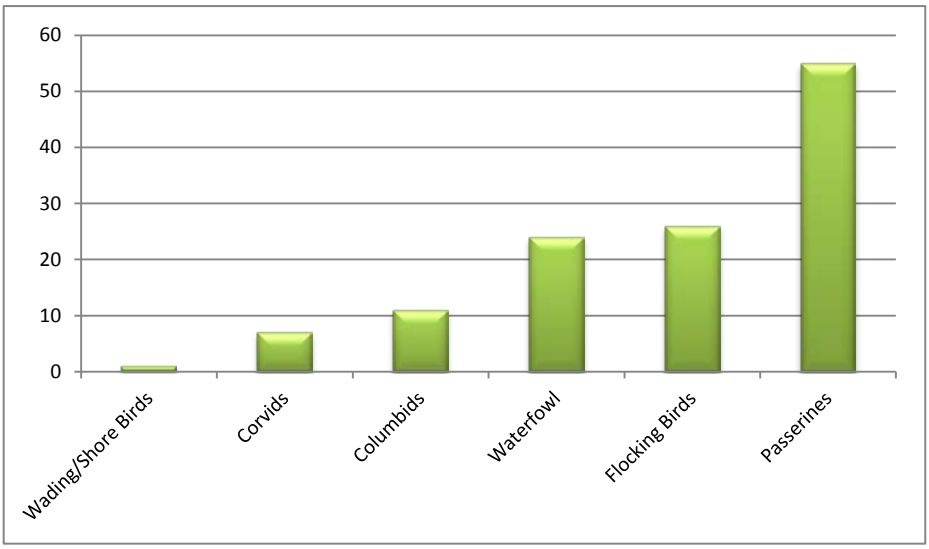


Figure 59. Abundance of birds and mammals by guild observed at Daniel Webster College Marsh during Boire Field's WHA from October 2013 through September 2014.

10.3 Bertucci's Restaurant Pond

Bertucci's is located approximately 0.2 miles from the midline of runway 14/32. The pond is surrounded by commercial businesses and parking lots and the landscaping is meticulously maintained with manicured trees and shrubs, turf grass and benches. Twenty-five species totaling 433 individuals were observed at this site. Canada geese were the most abundant, observed on 12 out of 17 surveys, totaling 333 individuals. "No feeding signs" have been erected at this known feeding site, with little results. Surveys indicate that geese nesting in the area of Pond 2, on the northwest side of the airport, are traveling across the runway with their goslings to utilize this pond creating a serious hazard to aviation.

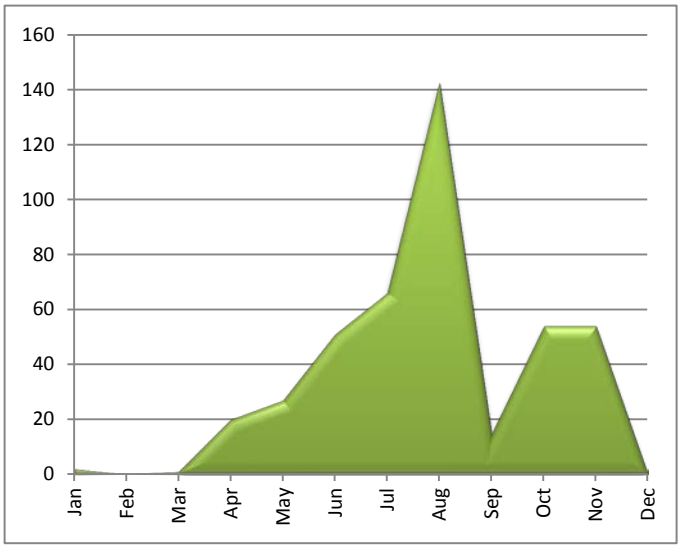


Figure 60. Monthly wildlife abundance at Bertucci's Restaurant pond from October 2013 through September 2014.

Canada geese and mallards accounted for 85% of all individuals observed. Bird observations at this location ranged from a high of 143 individuals in August to a low of zero individuals in both February and December (Figure 60) after the pond froze. Waterfowl, Passerines, flocking birds, gulls and Corvids were the top 5 guilds identified at this site (Figure 61). Specifically, Canada geese (n=333), mallards (n=33), common grackles, American robins and cedar waxwings were the five most commonly observed species.

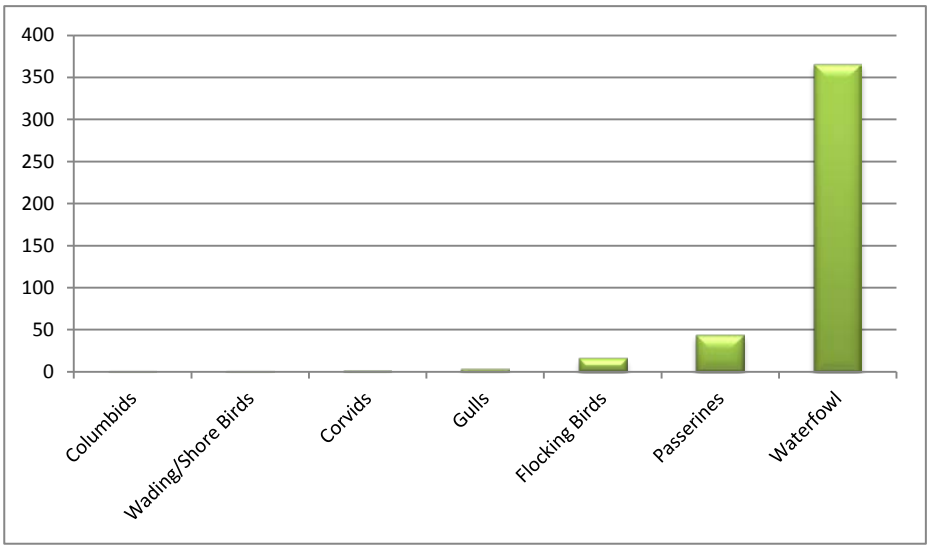


Figure 61. Abundance of birds and mammals by guild observed at Bertucci's Restaurant pond during Boire Field's WHA from October 2013 through September 2014.

10.4 Pennichuck Watershed at Manchester Street

Pennichuck Watershed at Manchester Street is located approximately 1.5 miles northeast of the approach end of runway 32. The watershed is comprised of a number of ponds including Stump, Pennichuck, Holts, Harris and Supply Ponds. The entire watershed contains approximately 351 acres of surface water and is the primary drinking water supply for the City of Nashua. During the WHA, Harris Pond was surveyed. Twenty species of birds were identified at this location totaling fifty individuals during the WHA with blue jays and tufted titmouse the most abundant species. Heavy construction at this site during most of the WHA probably lead to fewer observations in species totals and total abundance.

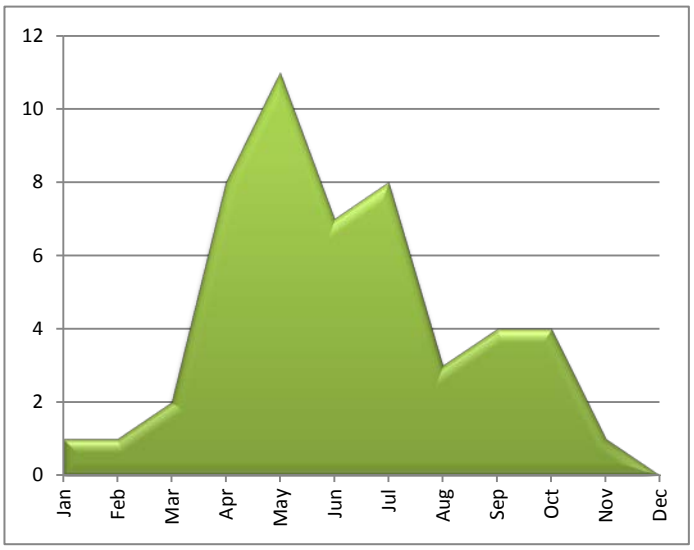


Figure 62. Monthly wildlife abundance at Pennichuck Watershed at Manchester Street from October 2013 through September 2014.

This area also serves as a bald eagle nesting area. A breeding pair of eagles have successfully fledged two eaglets, each of the last two years (Chris Martin, personal communication, Audubon Society of NH, December 2014).

Passerines accounted for 71% of the total observations of birds at this site. Birds observed at this location ranged from a high of 11 individuals observed in May to a low of zero individuals observed in December (Figure 62). Passerines, Corvids, waterfowl, wading/shorebirds and raptors were the top 5 guilds identified (Figure 63). Blue jays (n=6), tufted titmouse (n=6), black-capped chickadees (n=5), American robins (n=4) and chipping sparrows (n=4) were the top 5 species identified.

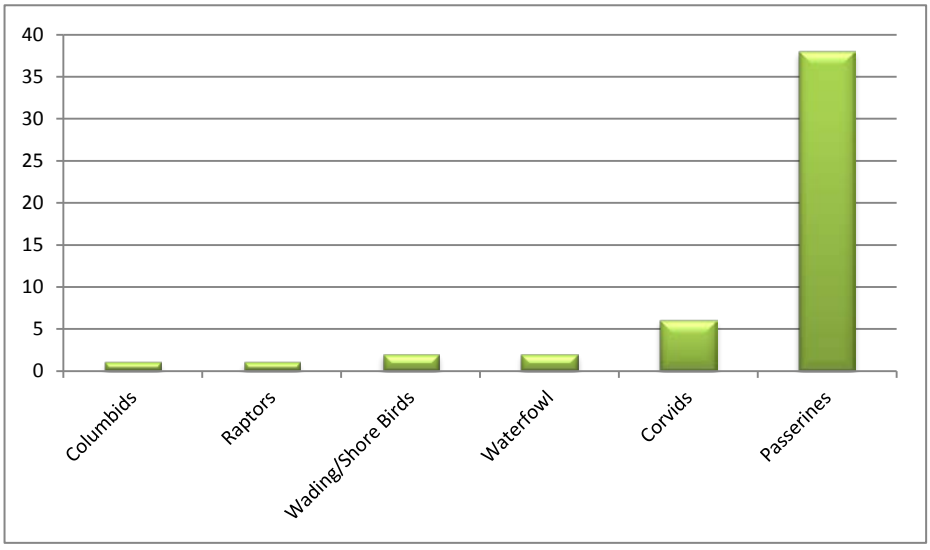


Figure 63. Abundance of birds and mammals by guild observed at Pennichuck Watershed at Manchester Street during Boire Field's WHA from October 2013 through September 2014.

10.5 Mine Falls Park at Soifert Playing Fields

The Mine Falls Park survey location is approximately 1.3 miles southeast of the approach end of runway 32. The park encompasses 325 acres and includes forest, wetlands and open fields. Mine Falls Park is a recreational park that offers walking, kayaking, cross-country, skiing and biking and includes several fields used for organized sports. This monitoring site was chosen for the athletic fields, which could be feeding area for Canada geese. During the WHA, a total of 270 wildlife observations were made at this location. American robins were the most abundant species identified. Only one Canada goose was observed at the park during the entire monitoring period.

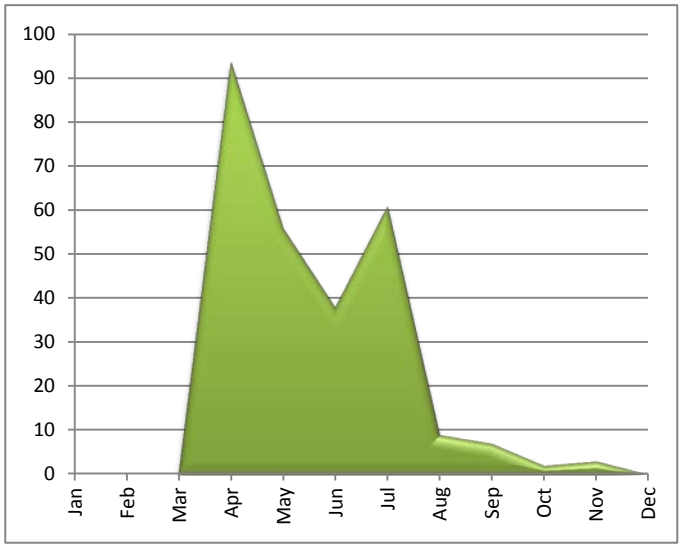


Figure 64. Monthly wildlife abundance at Mine Falls Park at Soifert Playing Fields from October 2013 through September 2014.

Passerines accounted for 87% of all individuals observed at Mine Falls Park. Birds observed at this location ranged from a high of 94 individuals in April to a low of zero individuals in the months of January, February, March and December (Figure 64). Passerines, flocking birds, Columbids and Corvids were the top 4 guilds identified (Figure 65), with American robins (n=191), common grackles (n=17), American goldfinch (n=10), chipping sparrow (n=9) and brown-headed cowbird (n=6) the top five species identified during the WHA.

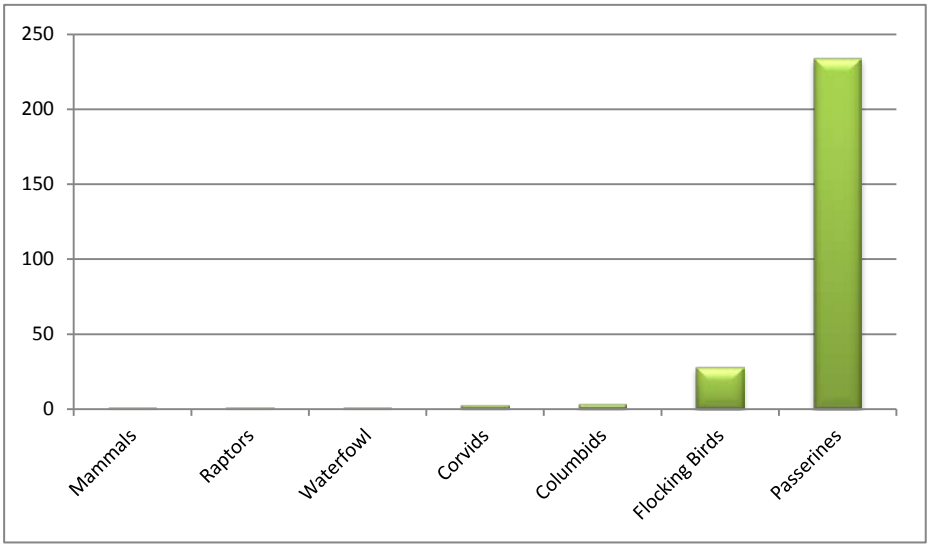


Figure 65. Abundance of birds and mammals by guild observed at Mine Falls Park at Soifert Playing Fields during Boire Field's WHA from October 2013 through September 2014.

10.6 Mill Pond and Boat Launch at Mine Falls Dam

Mill Pond and the boat launch at Mine Falls Dam are approximately 2.1 and 2 miles, respectively, to the south of the approach end of runway 32 at Boire Field. Mill Pond provides access to the canal for canoes and kayaks, and entry to the Mine Falls trail network east and west. The boat launch at Mine Falls Dam provides boat access to the Nashua River. Both sites consist of mature mixed hardwood/coniferous forest, herbaceous woody vegetation and aquatic plants. During the WHA, 38 species totaling 259 individuals were observed between the two sites. The tree swallow was the most abundant species observed (n=27).

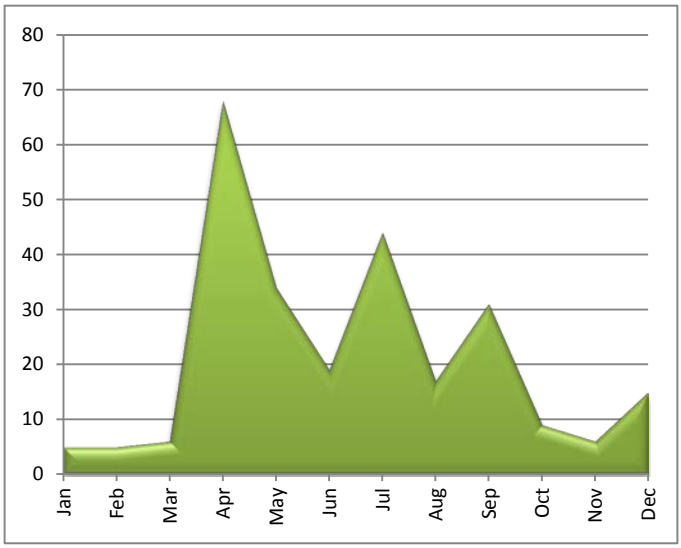


Figure 66. Monthly wildlife abundance at Mill Pond and Boat Launch at Mine Falls Dam from October 2013 through September 2014.

Geese, ducks and gulls accounted for 30% of all observations. The Canada goose was the second most abundant species observed at Mill Pond and the Boat Launch at Mine Falls Dam. Birds observed at these locations ranged from a high of 68 individuals in April to a low of 5 individual in both January and February (Figure 66). Passerines, Waterfowl, Gulls, Corvids and Wading/Shorebirds were the top five guilds observed (Figure 67). Tree swallows (n=27), Canada geese (n=26), herring gulls (n=25), mallards (n=17) and black-capped chickadees (n=11) were the five most commonly observed species.

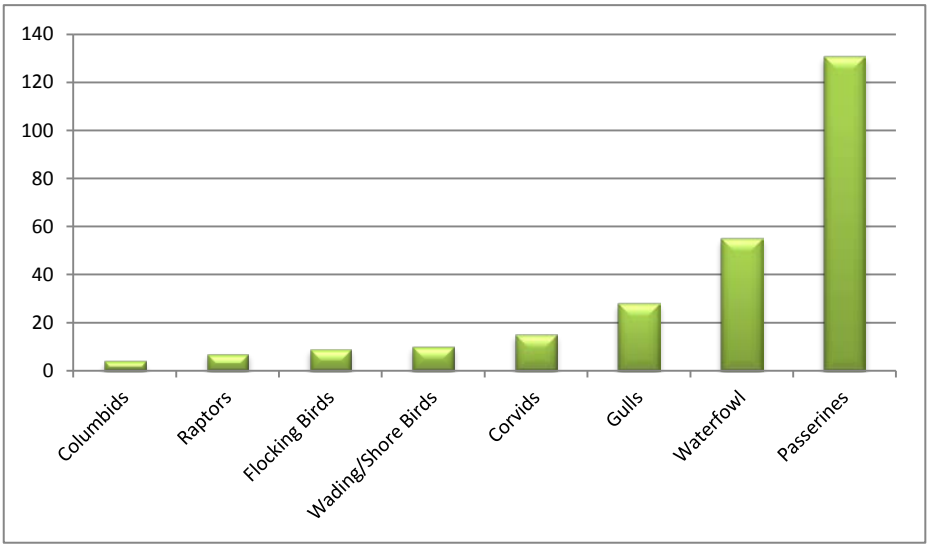


Figure 67. Abundance of birds and mammals by guild observed at Mill Pond and Boat Launch at Mine Falls Dam Park during Boire Field's WHA from October 2013 through September 2014.

10.7 Four Hills Landfill

The Four Hills Landfill is located about 3.5 miles south of Boire Field. The approximately 265 acre landfill is owned and operated by the City of Nashua. It has been open since 1970 for disposal of municipal solid waste and recyclables from residences and businesses in the City of Nashua. Municipal solid waste landfills are highly attractive to many species of wildlife, in particular gulls, vultures and European Starlings, all of which are hazardous wildlife species to aviation due to flocking and soaring behavior. FAA AC No: 150/5200-33B provides guidance on certain land uses that have the potential to attract hazardous wildlife and speaks specifically to consideration for existing waste disposal facilities within the limits of separation criteria in section 2-2 of the document.

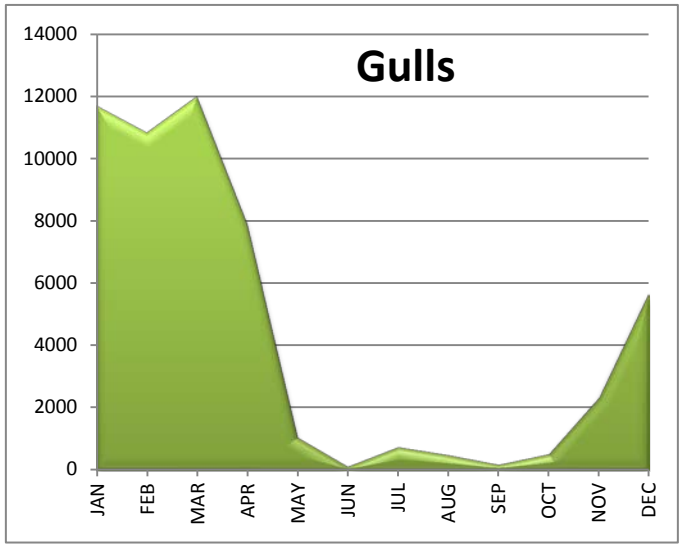


Figure 68. Monthly gull abundance at Four Hills Landfill from October 2013 through September 2014.

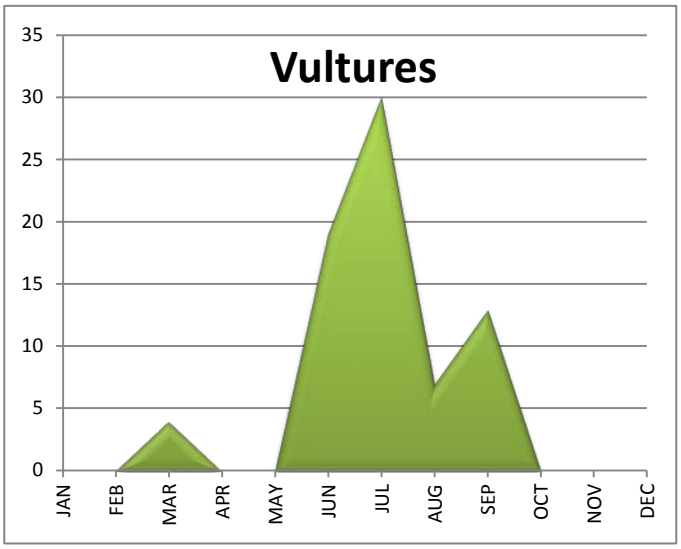


Figure 69. Monthly turkey vulture abundance at Four Hills Landfill from October 2013 through September 2014.

Data analyzed is based on monitoring efforts performed 8 hours a day 5 days per week. Data is generated from an existing agreement at this site monitoring wildlife use of the landfill. Considering the amount of time spent at this site and the large number of wildlife documented the primary focus of this discussion will be gulls and turkey vultures.

During the WHA, a total of 53,678 gulls and 73 vultures were observed at the Four Hills Landfill. Gull activity was highest in the winter and early spring, when gulls utilize the landfill as a food source (Figure 68). During the summer and fall gulls disperse from the landfill as other food sources become available. Turkey vultures were present at the landfill during March, with an increase in observations in June and July (Figure 69). Vultures were observed kettling (soaring) above the landfill and loafing on the cell tower and litter fence poles. Based on the hazards that both gulls and vultures pose to aircraft, future aircraft operations around the landfill should be examined and pilots should be warned about aircraft operations in that airspace.

10.8 Horseshoe Pond, Merrimack

Horseshoe Pond is an oxbow pond that surrounds a small inhabited island. It is located in the town of Merrimack, approximately 4.5 miles north of Boire Field. This 44 acre pond provides a public access site for boaters, fishermen and residents. Habitat includes mixed hardwood/coniferous forest, scrub/shrub and aquatic vegetation. A marshy wetland is located on the south end of the pond.

During the WHA, 33 species were observed at Horseshoe Pond totaling 232 individuals. Horseshoe Pond had a high abundance of species diversity however; abundances were low in January and February when the pond froze (Figure 70).

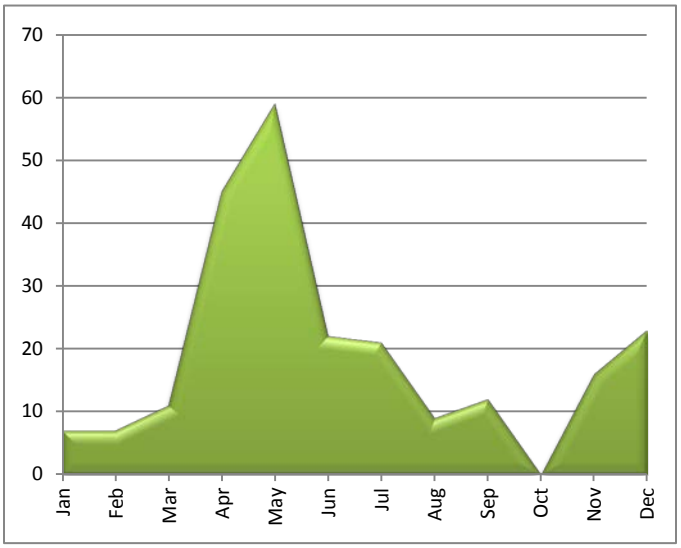


Figure 70. Monthly wildlife abundance at Horseshoe Pond from October 2013 through September 2014.

Waterfowl, Passerines, flocking birds, Corvids and wading/shorebirds were the top 5 guilds observed at this site. Waterfowl and flocking bird species accounting for 58% of all wildlife observed (Figure 71). The five most abundant species were red-winged blackbirds (n=43), mallards (n=42), blue jays (n=15), common grackles (n=15) and tree swallows (n=15).

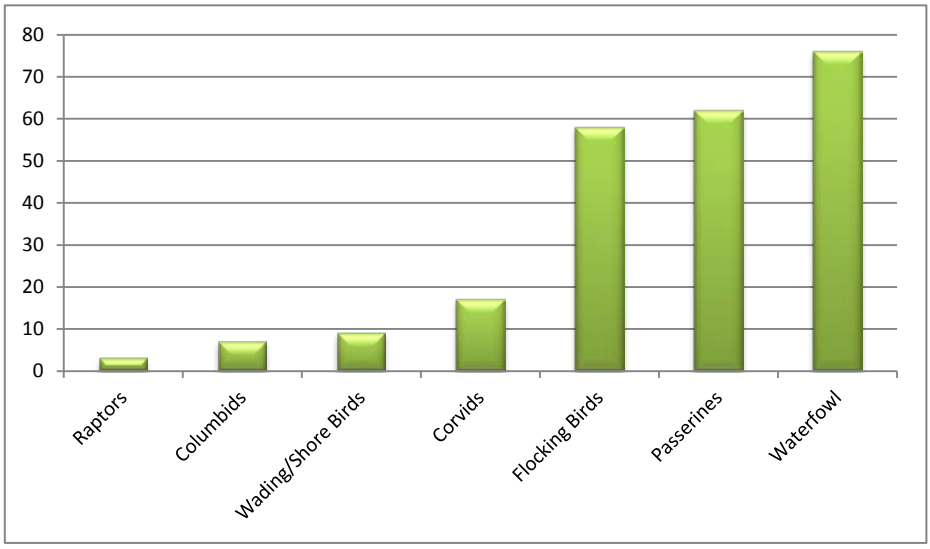


Figure 71. Abundance of birds by guild observed at Horseshoe Pond during Boire Field's WHA from October 2013 through September 2014.

11.0 Conclusions

This WHA was prepared to determine wildlife activity and attractants at Boire Field and its critical airspace. This WHA provides a basis for establishing management strategies for Boire Field to mitigate current and future wildlife hazards. Our conclusions and recommendations are based on a comprehensive ecological assessment of wildlife activity including avian and mammalian populations, habitat use and methods to reduce or eliminate hazardous wildlife and attractive wildlife habitat.

(1) WS concludes Boire Field management and operations staff currently follow procedures to quickly respond to and successfully mitigate wildlife hazards as they emerge. Mitigation efforts include harassment and lethal removal when deemed necessary. Airport management clearly regard wildlife management as a priority and allocates resources and personnel as time and budget constraints allow.

(2) WS concludes that wildlife populations, behavior, and habitat use associated with Boire Field present a risk to aviation operations. Some wildlife populations and habitats at Boire Field can be reduced to acceptable levels provided Boire Field personnel implement the recommendations provided herein.

(3) WS concludes that wildlife populations and activities among adjacent properties and identified off-site hazard locations within Boire Field's 5-mile separation zone pose a risk for aviation operations. Thus, appropriate management actions to mitigate these risks must be taken. Wildlife hazards can be managed provided Boire Field personnel implement the recommendations provided. Establishing cooperative relationships with adjacent landowners, businesses and municipalities, along with educating those entities about wildlife hazards to aircraft will increase public awareness and ultimately reduce potential hazards at Boire Field.

Before implementing any of the following recommendations, it must be understood that there are various management actions that can be taken to decrease wildlife hazards. Depending on the wildlife species, habitat, behavior, season, temporal activity and space use on/near Boire Field, management techniques can be directed to reduce wildlife numbers, habitats and other potential attractants. Information on reducing and/or eliminating wildlife hazards is available through a variety of printed and online sources: *Resolving Human-Wildlife Conflicts: The Science of Wildlife Damage Management (Conover 2001), ACRP Report 32: Guidebook for Addressing Aircraft/Wildlife Hazards at General Aviation Airports, Synthesis 23: Bird Harassment, Repellent, and Deterrent Techniques for Use on Airports, Synthesis 39: Airport Wildlife Population Management, Synthesis 52: Habitat Management to Deter Wildlife at Airports*.[1] Understanding species ecology, along with ingenuity, persistence and documentation can greatly augment the duration and effectiveness of any wildlife hazard reduction technique ultimately aiding an airport's overall wildlife management program.

[1] Available at http://www.faa.gov/airports/airport_safety/wildlife/resources/

12.0 Management Recommendations

The USDA, Wildlife Services Program promotes an Integrated Wildlife Damage Management (IWDM) approach (sometimes referred to as "Integrated Pest Management" or IPM) in which a series of methods may be used or recommended to reduce wildlife damage. These methods include altering cultural practices as well as habitat and behavioral modification to prevent damage. Sometimes controlling wildlife damage requires that the offending animal(s) be killed or that populations of the species be reduced.

The following recommendations are presented as a means to begin the process of reducing or eliminating wildlife hazards observed at Boire Field during the wildlife hazard assessment. They provide some initial context based on the WHA that should be detailed and adapted into a future Wildlife Management Plan. If followed, these recommendations will result in a significant reduction of current wildlife hazards at Boire Field, but they do not replace the need to continue to monitor for new hazards. Specific action recommendations are presented from most important concerns to least important concerns in terms of the potential hazard to aircraft. Following these action recommendations are programmatic recommendations that complement the specific-action recommendations by offering organizational advice for a well-rounded wildlife management program. In resolving any wildlife damage problem, there are three general categories of methods that can be applied to reduce the damage, in this case, the hazards to aviation. Resolution of wildlife hazards can be achieved by:

- **Managing the resource**, referring to any method undertaken to make the site, in this case the airport or neighboring properties, less attractive to certain wildlife;
- **Managing the wildlife**, referring to any method directed at certain wildlife to reduce their numbers;
- **Install barriers** between the wildlife and the site so as to make it unavailable to wildlife.

These methods can be used singly, in sequence or in combination. Rarely is one method consistently and continuously effective. Generally, the most effective approach is to incorporate many methods into an integrated wildlife damage management strategy. The following recommendations will reflect that philosophy. WS can supply resources for any of the items listed in the following recommendations.

The recommendations for managing wildlife hazards at Boire Field are divided into three sections: Habitat Management Recommendations, Wildlife Control Recommendations and General Recommendations. While all recommendation sections are important, the management of habitat will have the most lasting effect by reducing the use of the airport by hazardous animals and should be implemented immediately.

12.1 Boire Field Specific Recommendations

Habitat Management (Vegetation and Water)

Managing airfield habitats is considered the most important approach to reduce wildlife use at airports (Washburn et al. 2007). Management techniques focused on reducing habitat include vegetation management and water management. Activities such as mowing and removing standing woody vegetation are focused on reducing food and cover from the airport environment. Activities such as reducing standing and open water sources focus on eliminating loafing areas used by birds at the airport. Airport environments are primarily managed grasslands providing wildlife foraging opportunities, especially unique when juxtaposed with urban and suburban human development. Consequently, the airfield itself is a hazard to aviation operations and must be managed accordingly.

Vegetation Management – Trees and Shrubs

Remove Trees and Vegetation Inside Airport Perimeter

All trees, shrubs and other vegetation should be cleared from within the AOA and surrounding airport property. These areas provide cover, bedding sites, nesting sites and perches for many bird species and are also utilized by other species of wildlife. Shrubs and bushes provide cover for small rodents that serve as prey for raptors, foxes and coyotes. All mast and fruit producing vegetation should be removed because they provide a source of food for many birds and mammals including starlings, turkeys and deer.

Specific vegetation removal recommendations include (Figure 72).

- Remove the woodland[2] located between India ramp and hangars (Area 1, Figure 72).
- Remove the woodland and all associated trees and shrubs from the area west and northwest of India ramp, including the all trees, shrubs and vegetation between and around ponds 1, 2 and 3 (Area 2, Figure 72).
- Remove the woodland and all associated trees and shrubs from the north side of the airfield, which encompasses the entire length of the perimeter fence along the railroad tracks from Charron Ave to Deerwood Drive (Area 3, Figure 72).
- Remove fruit producing shrubs from around all hangars and buildings (Area 4, Figure 72).
- Clear shrubs and small trees from around perimeter fence on hill south of small field by India ramp (Area 5, Figure 72).
- Remove stands of mature trees south of DWC aviation school parking area (Area 6, Figure 72).
- Remove fruit trees from DWC aviation school parking lot (Area 7, Figure 72).
- Remove vegetation from north side of runway 14/34 (Area 8, Figure 72).

[2] Woodland referred to in this recommendation is in a wetland. Any modification should comply with federal, state or local laws.

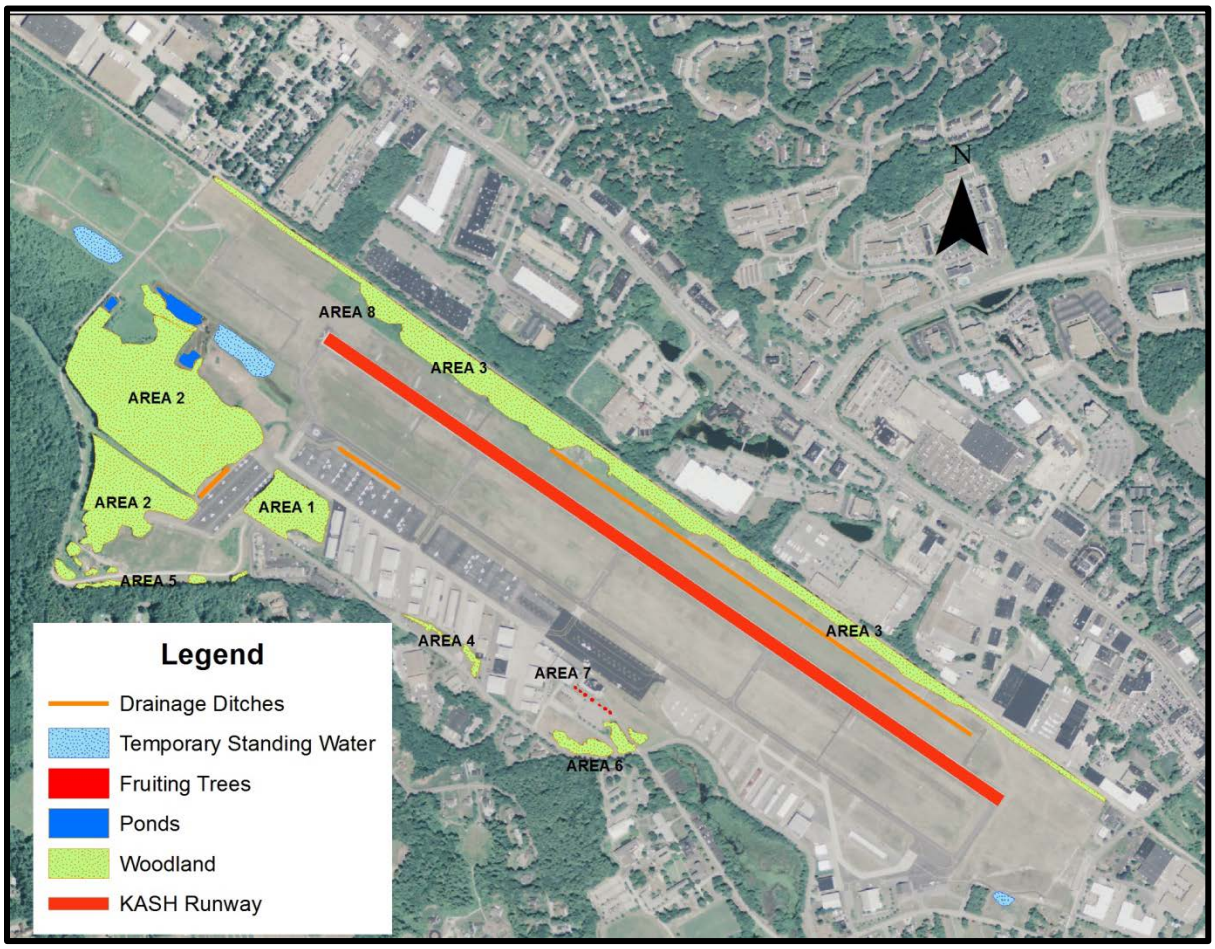


Figure 72. Vegetation removal areas and attractive features to wildlife at Boire Field.

Vegetation Management - Grass

Incorporate Grass Management

Mow grass as needed to maintain and encourage dense uniform growth and height on the entire airfield of 7 to 14 inches. Mow grass shorter than 7 inches only in FAA mandated areas around the safety area and lights. Maintaining uniform mowing heights where applicable by law will help reduce the number of species that hunt edge habitat (crows, coyotes, foxes, raccoons and skunks). Mowing in the spring should begin when the grass reaches 14 inches or grass seed heads form, typically by the end of May and June. This mowing regime will help to keep grass at a height that will limit cover for rodents that serve as a prey base, or allow the grass to reach a height that will produce seeds, create forage or harbor insects desired by birds.

A solid dense grass cover with moderate height will also help to deter usage by doves, geese blackbirds and many other grassland species. This grass height will be tall enough to obstruct the vision of these birds, making it unattractive to them and thereby reducing utilization. In conjunction with keeping airfield grass mowed at a height of 7-14 inches, WS also recommends using varieties of tall fescue grass that are infected with fungal endophytes in areas that are to be reseeded. Endopyhte infected grasses are unpalatable to avian and mammalian species and may support fewer insect numbers (Washburn and Seamans 2007). Establishing grass ground cover is preferred over annual broadcast seeding or tilling.

Specifically, the fields and open areas should be cleared of all bushes, shrubs and trees. Any mast producing plants should be removed and a uniform monoculture of grass cover should be the only vegetation type permitted.

Remove grass growing through the concrete and asphalt

Remove grass growing through concrete and asphalt to remove ideal nesting habitat for Killdeer which was the most prevalent shorebird observed during the WHA. Use both chemical applications such as Round-Up® to spray and kill vegetation[3] and equipment such as a road grader to remove heavily mounded vegetation growing through expansion cracks and weathered surfaces. In addition, use equipment that will sweep the remaining dirt and vegetation from hard surfaces to remove nesting material.

Grass growing through pavement at Boire Field

[3] Requires certified pesticide applicators license. May require additional state permits.

Water Management

Manage Water Detention and Retention Areas

Water detention and retention areas are highly attractive to many species of wildlife, specifically hazardous species such as waterfowl and wading/shorebirds. Often, vegetation that is allowed to grow around these areas can provide nesting, cover and perching sites for a number of species of birds and small mammals. All areas on the airfield designed to hold or drain water need to be managed for proper drainage, kept free of standing or open water and cleared off all vegetation. At Boire Field three major water attractants and one minor water attractant exist. Specifically, the major water attractants are referred to by airport personnel as Ponds 1, 2 and 3. Open water exists during spring, summer and fall months when these areas are not frozen. During the WHA ducks, geese, shorebirds, herons and beaver were observed utilizing these ponds. In fact, Canada geese were assumed to have nested and successfully fledged goslings in the area around these ponds.

Standing water in drainage swale

Conduct nest and egg destruction for Canada geese that are nesting in the area, especially those in the immediate vicinity of the airfield. Airport personnel must register with the USFWS Migratory Bird Permit Office to oil or addle goose eggs or remove nests from March 1-June 1 (https://epermits.fws.gov/eRCGR/geSI.aspx?ReturnUrl=%2feRCGR).

Because these ponds are designed to hold water, measures need to be taken to decrease attractiveness. For example, along with habitat management, bird balls, netting and overhead wires are three examples of exclusion methods that can be used to deter waterfowl use of standing water at these locations.

Canada geese with goslings at Pond 2

The minor water attractant is the drainage swale that lies to the north of and runs parallel to runway 14/32 from the 32 obstruction tower. Standing water was observed after significant rain events and during spring thaw. While no waterfowl or wading/shorebirds were observed utilizing this feature the potential exists as a hazardous water attractant. Boire Field should incorporate a wire grid or fill the swale with riprap, or an equivalent, that does not allow for standing water to develop. Mitigation efforts should not impact the glide slope critical area and should be acceptable to the FAA.

Temporary standing water should also be addressed when observed at Boire Field. During the WHA, temporary standing water was prevalent throughout the airfield after rain events and during spring thaw. Particular areas of concern were observed along the access road to the 14 approach lights and to the south of the access road to 14 localizer critical area. If possible, future airport projects in these areas should incorporate grading or drainage improvements to mitigate standing water. When standing water is observed on the asphalt or concrete it should be removed by sweeping. Airport operations should patrol the airfield after significant rain events and immediately harass any wildlife utilizing temporary water sources.

Temporary standing water along access road to 14 approach lights

Wildlife Management - Exclusion

Perimeter Fencing

The perimeter fence at Boire Field is comprised of 8 foot chain-link with barbed wire outriggers and 4 foot chain-link with no barbed wire. Based on deer observed inside the perimeter fence during the WHA, the perimeter fence at Boire Field is inadequate to exclude deer from the airfield. At the time of writing of this WHA, Boire Field was removing the section of 4 foot chain-link fence and a section of existing 8 foot fence that runs from Charron Avenue to Deerwood Drive and installing new 8 foot chain link. The new section of 8 foot fence replacing the 4 foot fence designed without barbed wire outriggers. WS recommends that Boire Field continue to actively monitor and document deer observed inside the perimeter fence and, if deer continue to be present, install three strands of barbed wire outriggers to the fence. An additional four feet of chain link should be buried underground, at a 45^{o} angle, to prevent wildlife from digging under the fence. Burying the fence to this depth may prove to be cost prohibitive for the airport. A less expensive variation is to grade off a five-foot wide swath of the topsoil along the outside of the fence. Attach one end of the chain-link to the existing fence and lay the rest across the graded surface. With a road grader re-apply the topsoil over the fence and allow the vegetation to grow back to a manageable height. It's important to note that burying the fence any amount is preferable to not burying it at all. Additionally, a semi-circular concrete berm or speed bump should be constructed under perimeter fence gates with gaps four inches and larger to prevent wildlife from entering the airfield. The berm should be constructed to close these gaps to less than two inches in height, allow the gate to swing in both directions and allow vehicles to pass through safely and quickly. These recommendations follow FAA Certalert No. 04-16 "Deer Hazard to Aircraft and Deer Fencing" (Appendix G) that recommends a 10-12 foot chain-link fence with 3 strand barbed wire outriggers and also states that an airport may be able to use an 8 foot chain link fence with 3 strand barbed wire outriggers depending on the amount of deer activity in the area.

Large gap in perimeter fence at Boire Field

During the perimeter fence survey, numerous coyote and fox access points were identified along the entire length of the fence and foxes and coyotes were observed on the airfield during the WHA. Coyote and fox exclusion is difficult because these species have the ability to dig under and climb over fencing. WS recommends the Boire Field repair or retrofit any gaps greater than 4 inches in the perimeter fence and bury the fence whenever possible. In addition, Boire Field should conduct frequent perimeter fence checks for coyote and fox access points and manage them with exclusion materials. When coyotes and foxes are observed on the airfield they should be immediately dispersed or removed.

A short-term intensive trapping program should be initiated to remove those individuals that are habituated to the airfield. Contact WS for assistance with coyote and fox management.

Also, Boire Field should repair or replace the section of fence that parallels Charron Avenue when planning future fencing projects. This section of fence has numerous gaps and holes that allow access for a number of mammals, especially coyote and foxes.

Photo courtesy of birdbgone.com

Bird spikes preventing perching on ledge of building

Navigational Aids

Using exclusion devices (For example: Nixalite, spiderwire, bird coil or spike strips) helps to keep birds from using perches that cannot be removed from an airfield. Install bird spikes on signs immediately adjacent to runways and taxiways to reduce use by perching birds. Kestrels were observed multiple times perching on airfield location signs, FAA equipment and lighting equipment during the WHA, particularly in the runway 14 approach light system and the sign boxes along runway 14/32. Signs and lighting equipment are usually located next to runways increasing the possibility of a strike. Monitor wildlife use of other structures throughout the AOA, note activity in the wildlife log and install spikes on structures that are used as perching sites. No birds should be allowed to perch on structures within the AOA and should be harassed immediately upon detection.

Culverts

Install metal grates on all culverts that do not have grates to prevent wildlife movement on and off of airport property and to prevent skunks and raccoons from utilizing culverts to gain access to the AOA. Inspect grates to prevent debris from clogging the openings and accumulating standing water which serves as an attractant to waterfowl and gulls.

Wildlife Management - Harassment

WS Recommends Boire Field conduct an aggressive harassment effort towards birds and mammals on the AOA. While aviation safety is of paramount concern, it is recognized that the elimination of all wildlife hazards to aviation is impossible. It is also recognized that not all wildlife are equally hazardous to aviation. In consideration of this, there are guidelines that can be followed in order to effectively analyze the comparative threats posed by various wildlife species.

The conventional guideline in assessing threats posed by birds considers three priorities. They are, in descending order of severity, 1) large flocking birds such as gulls or waterfowl, 2) small flocking birds such as starlings, horned larks and snow buntings and 3) large singular birds such as hawks or herons. The rationale for this is that large birds, due to their greater body mass can strike an airplane with a much higher impact and thereby cause more damage. Not only do birds that congregate in large

flocks provide increased opportunities for a strike compared to solitary birds, flocking birds have the capacity to disable multiple engines.

There are a number of wildlife species/groups that represent a substantial threat to safe air operations at Boire Field including white-tailed deer, Canada geese, ducks and wild turkeys. In many cases control measures are the same for all groups addressed below; however, some groups require additional measures. Also, not all groups are considered primary (direct) threats to aircraft; some create secondary hazards [i.e. raccoons, opossums, skunks, etc., are not considered direct threats to aircraft, but create situations where a strike involving one of these species can attract another species that subsequently is struck by an aircraft and causes direct damage]. Despite not being considered a direct threat, sometimes wildlife considered to be secondary threats can result in direct damage in rare and unusual circumstances.

Once wildlife become established in an area, they will become increasingly difficult to disperse, especially if they begin nesting. Flocking birds such as ducks, geese, gulls, crows and blackbirds are attracted to other individuals or flocks already present on the airfield resulting in an increase in bird abundance. To prevent this decoying effect, all birds should be harassed from the airfield immediately and prevented from nesting, feeding, perching, or loafing on the airfield. Harassment of wildlife must occur when observed especially during peak activity periods such as morning and evening, and fall and spring migration. Wildlife will become habituated to the airfield if they are permitted to inhabit it. As such, it will be harder to provide future harassment techniques to disperse wildlife from Boire Field.

There are 3 categories of harassment techniques that are used to disperse wildlife; visual, auditory and chemical. Examples of visual harassment devices are effigies, windmills, brightly colored balloons and Mylar flagging. Visual based deterrents present wildlife with a stimulus that is unfamiliar or perceived as a threat, such as flashing lights or simulation of a predator. Auditory devices include distress calls, propane cannons and pyrotechnics. These techniques use loud noises as a negative stimulus to vector wildlife away from an area. Finally, chemical harassment of wildlife is accomplished by the use of repellents. Repellents typically provide a negative effect to the animal by ingestion of the repellent. Other repellents work by simulating the presence of a predatory animal. The best harassment strategy involves using a combination of all three techniques in conjunction with one another and varying the methods so wildlife does not acclimate to one technique.

Wildlife Management – Non-lethal Trapping (Relocation)

WS recommends Boire Field implement trapping protocols to control raptors that are habitually observed on the airfield and not responsive to harassment. Raptor trapping and relocation must be conducted in conjunction with WS and the NHFG.

Wildlife Management - Lethal Control

Shooting

Both federal and state permits are necessary prior to beginning lethal control on migratory birds and state managed species of birds and mammals. WS recommends Boire Field acquire a current Migratory Bird Depredation Permit from the USFWS and implement a lethal control program used to manage migratory birds that do not respond to non-lethal harassment methods or for migratory birds that create an immediate threat to human health and safety. No permits are needed to take European starlings, English sparrows or pigeons because they are introduced species. Boire Field currently has a state permit to conduct lethal control wild turkey and deer. The ability to conduct harassment and shooting needs to be in real time. This means having personnel on the airfield who closely monitor wildlife activity during regular wildlife patrols. These individuals need to be prepared to promptly respond to threats to aviation when they pose threats, i.e. geese feeding in close proximity to a runway or gulls loafing/feeding on a taxiway.

All personnel who conduct lethal control of wildlife, especially birds, should be trained in wildlife identification in order to avoid mistakes. An immature bald eagle can be mistaken for a vulture by an untrained person, the taking of which would be a violation of the Bald and Golden Eagle Protection Act. WS can provide training in the basics of bird identification for personnel who conduct control at airports. All personal who conduct lethal control of wildlife should be properly trained in the safe use, transportation and storage of firearms.

Currently Boire Field allows hunting by permission only for deer on the airfield. Individuals allowed to hunt on the airfield should be informed of safe areas to hunt, safe directions to shoot and proper removal of deer carcasses (i.e. bagging and removing gut piles) to ensure safety of airport patrons and eliminate possible attractants for scavenging mammals and birds.

Public sensitivity to lethal control should be considered and discretion is advised when using lethal reinforcement. However, public concerns over wildlife safety should not supersede those of aviation safety. Therefore, the airport should not hesitate to use lethal control when the situation warrants such an action.

Wildlife Management – Lethal Trapping

WS recommends Boire Field implement trapping protocols to control skunks, coyotes, woodchucks and fox and beaver on the airfield. Boire Field can implement its own trapping program for small mammals, fox and coyotes or may contact a state licensed Wildlife Control Operator (WCO) or WS for trapping assistance on the airfield. Personnel directed to trap mammals on the airfield should have proper training in trap handling, animal handling and euthanasia techniques. All animals trapped, except raptors, should be euthanized and disposed of. WS does not recommend relocating mammals. Relocation can spread disease, create a nuisance situation at the site of relocation and disturb wildlife already present at the site of relocation.

WS recommends Boire Field perform a Canada goose round-up if geese are observed on the airfield with goslings. Breeding adults molt during late June, rendering them unable to fly. During this time adults and goslings can be corralled and removed from the airfield. Also consider working with neighboring properties located within 5 miles of the airfield to conduct goose roundups. Contact WS for more information on goose round-ups.

12.2 General Recommendations

Develop an informal WHMP based on this WHA

A WHMP is a critical element for determining how wildlife hazards will be managed and who is responsible for their control. While Boire Field is not required to develop a formal WHMP, geographic location, presence of wildlife hazards, and overall wildlife activity suggest an informal WHMP for Boire Field would be beneficial. A WHMP plan, even informal, provides the framework for deterring wildlife and managing wildlife habitats on the airfield and includes sections on habitat management, available resources, training, control methods/techniques and evaluation. The WHMP would assist Boire Field in prioritizing future wildlife control efforts as well as exhibit due diligence.

Designate a Wildlife Coordinator

Airport management should appoint an "in house" wildlife coordinator to conduct, manage, and oversee all aspects of wildlife management at Boire Field. Further, additional staff should be trained and prepared to mitigate wildlife hazards when the wildlife coordinator is unavailable. The wildlife coordinator will be responsible for coordinating efforts to reduce wildlife hazards among adjacent properties. Cooperatively, it is the responsibility of airport management and the wildlife coordinator to implement recommendations provided by the WHA and the WHMP when drafted. The wildlife coordinator should participate in land use projects both on and off the airfield that could potentially affect Boire Field aviation operations regarding wildlife hazards. The coordinator should establish relations with a certified wildlife airport biologist to assess wildlife hazards at Boire Field and any potential impacts from future construction projects. Additionally, the wildlife coordinator will be responsible for:

- Obtaining and/or renewing appropriate wildlife depredation permits such as the USFWS migratory bird depredation permit and the NHFG wildlife damage depredation permit.
- Frequently conduct wildlife harassment techniques when necessary.
- Establish and maintain cooperative relations with wildlife management agencies (e.g. USFWS, WS and NHFG), airport planners, maintenance, operations, local animal control, City of Nashua, an airline representative and neighboring businesses associated with external wildlife hazards. This can be accomplished through a Wildlife Hazard Working Group (WHWG).
- Creating and maintaining a wildlife observation database to monitor wildlife activity with regards to daily, seasonal and annual trends.
- Creating and maintaining a wildlife management activities database to measure the effectiveness of wildlife control methods used and number of wildlife involved.

- Managing Boire Field's Wildlife Strike Database and ensuring that strike remains are collected properly and identified accurately by wildlife biologists or Smithsonian Institution personnel. Further, ensure proper reporting to the FAA Wildlife Strike Database (www.wildlife-mitigation.tc.faa.gov) or completing FAA Form 5200-7.
- Coordinating specialized wildlife hazard training for airport personnel, informing personnel of the importance of recognizing and reporting wildlife observations, hazards, behavioral trends, and aircraft strikes. In addition, the coordinator should provide monthly updates to airport personnel and FAA personnel regarding recent wildlife activity and progress on recommendations from the WHA and/or WHMP.
- Coordinate with maintenance personnel to maintain a current New Hampshire Commercial Pesticide Applicators License from the New Hampshire Division of Pesticide (NHDPC) for application of certain pesticides, insecticides and herbicides to deter wildlife.

Maintain Federal and State Wildlife Depredation Permits

The ability to respond to wildlife in a prompt and efficient manner is essential for providing safe aviation operations at Boire Field. In some instances, it may be required to lethally remove hazardous wildlife. To provide immediate response, USFWS migratory bird depredation permits should be annually renewed as required by the USFWS. As new species of migratory birds appear at Boire Field and are deemed threatening to aviation safety they should be added to the Migratory Bird Permit. Currently, the USFWS waives the $100 fee for processing the permit for municipal airports. The USFWS requires that WS assist in the application process by providing a WS Form 37 permit review. Additionally, annual take reporting should be accurately maintained and provided with the application documents. Boire Field should also maintain the state issued deer and turkey permit to remove either of those species of wildlife on or trying to access the airfield. Permits should be updated as needed to provide sufficient coverage to effectively deal with any wildlife situation that may arise and include at least the following species:

New Hampshire Fish and Game Department
White-tailed deer and wild turkey

USFWS
Canada geese, American black ducks, mallard ducks, hooded merganser, great blue heron, horned larks, snow buntings, killdeer, mourning doves, American crow, blue jay great black-backed gull, herring gull, ring-billed gull and turkey vultures

Exercise Due Diligence for Wildlife at Boire Field

Any wildlife observed on the airfield is considered hazardous. However, this does not suggest that every individual must be immediately mitigated. Airport personnel must be aware of different threat levels species are characterized before determining appropriate actions. Whenever harassing wildlife, use extreme caution for aircraft operations because dispersing animals can be unpredictable. In addition, a zero-tolerance policy regarding wildlife feeding should be implemented and enforced to all

tenants. Boire Field should consider posting "No Wildlife Feeding" signs at access gates because it is an effective way to educate all those who frequent the airfield.

Report Wildlife Strikes with Aircraft

Boire Field must continue to accurately report, in detail, all wildlife strikes with aircraft. Confirmation numbers produced from strike reports should be cross-referenced with Boire Field's wildlife activity log. Wildlife strike reporting should be a cooperative effort between airport operations and air traffic control tower (ATCT) personnel to ensure reporting accuracy while limiting redundancy. Airfield inspections and scheduled foreign object debris damage (FODD) walks provide excellent opportunities to search for animal carcasses on and around movement areas. All carcasses found within 250 ft. of a runway should be reported; however, it is WS belief to report all carcasses found on the airfield unless the cause of mortality is determined to be unrelated to an aircraft collision. Wildlife strikes can be reported to the FAA Wildlife Strike Database (www.wildlife-mitigation.tc.faa.gov) or by completing FAA Form 5200-7. If the species cannot be determined, feather, hair, tissue and blood samples can be submitted to the Smithsonian Institution for positive identification at the following address:

Smithsonian Institution
Division of Birds
NHBE-605 MRC 116
Washington, D.C. 20560

Conduct Airport Personnel Training in Various Aspects of Wildlife Management

Every Boire Field employee with the potential to encounter wildlife hazards on the airfield should be made aware of their responsibility to recognize and respond to any wildlife situation. Specifically, all personnel that have duties requiring access to the airfield should be trained to mitigate potential wildlife hazards accordingly. Depending on the situation, responses may include hazing or shooting, or it may simply require the employee to notify the wildlife coordinator, air traffic control, or other responsible parties that a wildlife hazard is present. Employees should be familiar with damage caused by wildlife and how to respond to potentially hazardous situations.

Wildlife hazard training has been conducted sporadically at Boire Field. Although not required for Boire Field, it would be beneficial to conduct annual wildlife training for all airport personnel that frequent the airfield so that they are able to recognize wildlife hazards when they see them. If a wildlife coordinator is designated, the wildlife coordinator may want to receive additional training such as firearms safety, wildlife identification and wildlife control techniques (ex. trapping). In addition, wildlife identification materials (ex. field guides) should be available to properly identify hazardous wildlife and wildlife strikes.

Have Control Supplies Readily Accessible During Patrols

It is recommended that operations vehicles operating on the airfield be equipped with some form of harassment device or firearm (e.g. pyrotechnic launcher or shotgun) to alleviate any wildlife threat to aircraft. At any given moment, wildlife can pose a threat to aviation operations, thus it is imperative that all operations vehicles be equipped with some type of control device. This will enable personnel to quickly and easily haze or remove any wildlife they may encounter while conducting other work duties. Control supplies should only be used by approved, trained personnel (Appendix H) for a list of wildlife management equipment suppliers). At a minimum, trained personnel that operate regularly on the airfield should have the following equipment available:

- 15 mm pyrotechnic pistol launcher and caps
- Bird bangers
- Screamer sirens
- Safety equipment (ear and eye protection)
- Bird and mammal identification field guide
- Additional supplies may include binoculars, audio and visual deterrents, and firearms such as shotguns, rifles and pistols.
- Bird strike collection kit including re-sealable plastic bags, Sharpie® markers, alcohol wipes, kitchen shears, FTA® DNA collecting cards, latex gloves, protective eyewear and FAA Form 5200-7 to submit unidentifiable birds to the Smithsonian

Wildlife Data Collection

Since May of 2012 Boire Field has kept a comprehensive wildlife log tracking wildlife use of the airfield. Included in the wildlife log are the mitigation efforts employed to manage wildlife on the airfield, locations of wildlife incidences and species information. It is recommended that Boire Field continue to document wildlife on the airfield. The documented wildlife data can be easily organized using data sheets incorporated into a computer database (i.e. Microsoft Excel). As such, wildlife records at Boire Field can be presented as charts, graphs and reports. Comprehensive data collection can provide immediate and accurate reporting to justify particular management actions such as removal. Furthermore, organized record keeping can be beneficial to airport personnel during litigation in the aftermath of a damaging wildlife strike.

Evaluate Potential Wildlife Hazards with Future Airfield Modifications

Land use modifications that are planned for Boire Field and/or surrounding areas should be examined by a certified airport wildlife biologist and the airport's wildlife coordinator. Construction projects can create hazards either during and/or after completion. The project coordinator, airport wildlife coordinator and a wildlife biologist should cooperatively determine the best management practices for any construction or land use modification with regards to wildlife attractiveness.

Reduce Perching Sites

Signs, fences, light posts, building ledges, lights, trees, vegetation, vehicles and any structure that sits above ground height may be used as a perch for birds. Raptors will take advantage of perches on an airfield to watch for prey. Removing perches whenever possible may reduce the time raptors spend in Boire Field airspace. Any unused poles, survey stakes or trees should be removed whenever possible. Often, raptors will perch on an instrument or sign that must remain. In those instances, there are several anti-perching devices commercially available that can be affixed at those sites which will force the birds to go elsewhere. There will be many places where attaching anti-perching devices will be impractical but there may be a few places where raptors are constantly perching that are particularly hazardous and where shooting would be problematic.

13.0 Summary

Recognizing and managing wildlife hazards at airports is critical to protecting aircraft and human health and safety. Each airport has its own unique challenges regarding wildlife usage based on airport location, surrounding habitat and specific attractants. Wildlife may utilize airport habitats for food, water and shelter. Attractants at airports include, but are not limited to, standing water, mast and fruit producing vegetation, grass, nesting sites, shrubs and perching opportunities including building ledges, snags and signs.

The objectives of this wildlife hazard assessment were to identify the species, numbers, locations, local movements, and daily and seasonal occurrences of wildlife observed; identify and locate features on and near the airport that attract wildlife; describe existing wildlife hazards to air carrier operations; review available wildlife strike records; and provide recommendations for reducing wildlife hazards. The recommendations provided are designed to aid Boire Field in mitigating wildlife hazards in and around the airfield.

Recommendations are to obtain a current migratory bird depredation permit; remove trees and shrubby vegetation from overgrown areas; replace, repair and monitor perimeter fence; continue and adjust mowing regimes to create less-desirable grassland habitat; increase harassment and lethal control of Canada geese, wild turkey, white-tailed deer, gulls, crows, and blackbirds; incorporate avian bird spikes and deterrents on navigational aids; repair or install culvert grates; modify areas near the infield prone to creating temporary standing water; and create a trapping initiative to remove hazardous mammals from the airfield. Programmatic recommendations are also provided including creation of a wildlife hazard working group (WHWG), designation of a wildlife coordinator and continuation of accurate reporting in the wildlife log. Implementation of these measures will reduce the frequency of and potential for wildlife strikes at Boire field.

As air travel increases and wildlife populations continue to expand, wildlife hazards will remain a concern at airports. By conducting hazard assessments, documenting current wildlife activity and understanding the reasons wildlife are utilizing the airport environment, managers can adapt to meet changing wildlife management needs, modify the environment and utilize control measures to mitigate wildlife hazards to the best extent possible. Continued measures will need to be utilized and adapted, and wildlife will need to be continually monitored for potential strike risks. Through adaptive management and habitat alteration, wildlife hazards at Boire Field can be significantly reduced.

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Appendix A. Species Identified During Boire Field's WHA

Guild/Species	Abundance
Columbid	**371**
Mourning dove	369
Rock dove	2
Corvid	**809**
American crow	617
Blue jay	189
Common raven	3
Flocking Birds	**3,813**
Brown-headed cowbird	1,156
Common grackle	42
European Starling	900
Horned lark	892
Red-winged blackbird	51
Snow bunting	772
Gulls	**105**
Great black-backed gull	13
Herring gull	10
Ring-billed gull	82
Passerine	**2,269**
American goldfinch	115
American pipit	184
American redstart	7
American robin	277
American tree sparrow	1
Baltimore oriole	9
Barn swallow	27
Black and white warbler	1
Black-capped chickadee	161
Blue-gray gnatcatcher	1
Bobolink	1
Brown creeper	1
Brown thrasher	19
Black-throated green warbler	1
Carolina wren	1
Cedar waxwing	166
Chipping sparrow	31
Chimney swift	18
Common yellowthroat	70
Chestnut-sided warbler	1
Dark-eyed junco	44
Downy woodpecker	49
Eastern bluebird	81
Eastern kingbird	74
Eastern meadowlark	8

Eastern phoebe	43
Eastern towhee	84
Eastern wood-pewee	6
Eastern whip-poor-will	3
Field sparrow	34
Great crested flycatcher	2
Golden-crowned kinglet	6
Gray catbird	62
Hairy woodpecker	8
Hermit thrush	1
House finch	4
House sparrow	64
House wren	2
Indigo bunting	27
Lapland longspur	2
Northern cardinal	43
Northern flicker	13
Northern mockingbird	44
Northern parula	10
Northern rough-winged swallow	4
Ovenbird	41
Pine warbler	5
Pileated woodpecker	3
Prairie warbler	34
Purple finch	1
Rose-breasted grosbeak	1
Red-breasted nuthatch	4
Red-eyed vireo	25
Savannah sparrow	100
Scarlet tanager	5
Song sparrow	32
Solitary vireo	6
Tree swallow	51
Tufted titmouse	37
Unidentified sparrow	74
Veery	7
Warbling vireo	1
White-breasted nuthatch	16
Wood thrush	10
White-throated sparrow	1
Yellow-rumped warbler	5
Raptor	**185**
American kestrel	116
Cooper’s Hawk	3
Great-horned owl	2
Northern harrier	7
Peregrine falcon	1

Red-tailed hawk	26
Sharp-shinned hawk	1
Turkey vulture	29
Upland Birds	**133**
American woodcock	5
Ruffed grouse	1
Wild turkey	127
Wading/Shorebirds	**809**
Double-crested cormorant	3
Great blue heron	5
Green heron	1
Greater yellowlegs	5
Killdeer	792
Least sandpiper	1
Lesser yellowlegs	1
Spotted sandpiper	1
Waterfowl	**596**
Canada goose	382
Hooded merganser	2
Mallard	212
Mammal	**77**
White-tailed deer	27
Woodchuck	15
Striped skunk	8
Feral cat	6
Red fox	3
Coyote	3
Beaver	3
Virginia opossum	2
Muskrat	2
Grey squirrel	2
Grey fox	2
Chipmunk	2
Raccoon	1
Black bear	1

Appendix B. Memorandum of Understanding (MOU) between FAA/WS

No. 12-34-71-0003-MOU

Memorandum of Understanding
between the
United States Department of Transportation
Federal Aviation Administration
and the
United States Department of Agriculture
Animal and Plant Health Inspection Service
Wildlife Services

ARTICLE 1

This Memorandum of Understanding (MOU) continues the cooperation between the Federal Aviation Administration and Wildlife Services (WS) for mitigating wildlife hazards to aviation.

ARTICLE 2

The FAA has the broad authority to regulate and develop civil aviation in the United States[1]. The FAA may issue Airport Operating Certificates to airports serving certain air carrier aircraft. Issuance of an Airport Operating Certificate indicates that the airport meets the requirements of Title 14, Code of Federal Regulations, part 139 (14 CFR 139) for conducting certain air carrier operations.

The WS has the authority to enter agreements with States, local jurisdictions, individuals, public and private agencies, organizations, and institutions for the control of nuisance wildlife[2]. The WS also has the authority to charge for services provided under such agreements and to deposit the funds collected into the accounts that incur the costs[3].

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[1] Federal Aviation Act of 1958, 49 U.S.C. § 40101, et. seq.

[2] The Animal Damage Control Act of March 2, 1931, as amended, 46 Stat. 1468; 7 U.S.C. 426 – 426b.

[3] The Rural Development, Agriculture, and Related Agencies Appropriations Act of 1988, as amended, 426c to U.S.C. 426 – 426b.

14 CFR 139.337 requires the holder of an Airport Operating Certificate (certificate holder) to conduct a wildlife hazard assessment (WHA) when specific events occur on or near the airport. A wildlife management biologist who has professional training and/or experience in wildlife hazard management at airports, or someone working under the direct supervision of such an individual, must conduct the WHA required by 14 CFR 139.337. The FAA reviews all WHAs to determine if the certificate holder must develop and implement a wildlife hazard management plan (WHMP) designed to mitigate wildlife hazards to aviation on or near the airport.

These regulations also require airport personnel implementing an FAA-approved WHMP to receive training conducted by a qualified wildlife damage management biologist.

ARTICLE 3

The FAA and the WS agree to the following.

a. The WS has the professional expertise, airport experience, and training to provide support to assess and reduce wildlife hazards to aviation on and near airports. The WS can also provide the necessary training to airport personnel.

b. Most airports lack the technical expertise to identify underlying causes of wildlife hazard problems. They can control many of their wildlife problems following proper instruction in control techniques and wildlife species identification from qualified wildlife management biologists.

c. Situations arise where control of hazardous wildlife is necessary on and off airport property (i.e., roost relocations, reductions in nesting populations, and removal of wildlife). This often requires the specialized technical support of WS personnel.

d. The FAA or the certificate holder may seek technical support from WS to lessen wildlife hazards. This help may include, but is not limited to, conducting site visits and WHAs to identify hazardous wildlife, their daily

and seasonal movement patterns and habitat requirements. WS personnel may also provide:

i. support with developing WHMPs including recommendations on control and habitat management methods designed to minimize the presence of hazardous wildlife on or near the airport;

ii. training in wildlife species identification and the use of control devices;

iii. support with managing hazardous wildlife and associated habitats; and

iv. recommendations on the scope of further studies necessary to identify and minimize wildlife hazards.

e. Unless specifically requested by the certificate holder, WS is not liable or responsible for development, approval, or implementation of a WHMP required by 14 CFR 139.337. Development of a WHMP is the responsibility of the certificate holder. The certificate holder will use the information developed by WS from site visits and/or conducting WHA in the preparation of a WHMP.

f. The FAA and WS agree to meet at least yearly to review this agreement, identify problems, exchange information on new control methods, identify research needs, and prioritize program needs.

ARTICLE 4

The WS personnel will advise the certificate holder of their responsibilities to secure necessary permits and/or licenses for control of wildlife. This will ensure all wildlife damage control activities are conducted under applicable Federal, State, and local laws and regulations.

ARTICLE 5

This MOU defines in general terms, the basis on which the parties will cooperate and does not constitute a financial obligation to serve as a basis for expenditures. Request for technical, operational, or research assistance that requires cooperative

or reimbursable funding will be completed under a separate agreement.

ARTICLE 6

This MOU will supersede all existing MOUs, supplements, and amendments about the conduct of wildlife hazard control programs between WS and the FAA.

ARTICLE 7

Under Section 22, Title 41, U.S.C., no member of or delegate to Congress will be admitted to any share or part of this MOU or to any benefit to arise from it.

ARTICLE 8

This MOU will become effective on the date of final signature and will continue indefinitely. This MOU may be amended by agreement of the parties in writing. Either party, on 60 days advance written notice to the other party, may end the agreement.

OSB Woodie Woodward
Associate Administrator for Airports
Federal Aviation Administration

Date June 20, 2005

OSB William H Clay
Deputy Administrator for Wildlife Services
Animal and Plant Health Inspection Service

Date June 27, 2005

Appendix C. Memorandum of Understanding (MOU) Between NASAO/FAA/WS

MEMORANDUM OF UNDERSTANDING
BETWEEN THE
NATIONAL ASSOCIATION OF STATE AVIATION OFFICIALS
THE
FEDERAL AVIATION ADMINISTRATION
AND THE
UNITED STATES DEPARTMENT OF AGRICULTURE
ANIMAL AND PLANT HEALTH INSPECTION SERVICE
WILDLIFE SERVICES

ARTICLE 1 - PURPOSE

This Memorandum of Understanding (MOU) establishes a joint cooperative relationship between the National Association of State Aviation Officials (NASAO), the Federal Aviation Administration (FAA), and the United States Department of Agriculture Animal and Plant Health Inspection Service (USDA APHIS) Wildlife Services (WS). The purpose of this MOU is to replace the prior FAA/NASAO initiative and USDA APHIS/NASAO MOU. It is to also establish the partnership and cooperation of these three organizations to reduce the risk of wildlife hazards at airports. This partnership supports the organizations' common mission to advance and encourage aviation safety within their respective areas of responsibility and to reduce wildlife hazard risks through education, research, and outreach.

ARTICLE 2 - BACKGROUND

An initiative under the FAA/NASAO MOU (May 20, 2010) and an MOU between USDA APHIS and NASAO (October 4, 2006) currently exists. This new partnership seeks ways to:

- Improve reporting of wildlife strike data at airports;
- Educate the general aviation community;
- Provide technical and operational assistance to the aviation community; and
- Research the most efficient and cost effective ways to mitigate wildlife risk at airports when necessary.

This agreement provides a framework for cooperation and encourages collaboration between the three organizations. It promotes effective communication to advance efforts critical for safety, security, efficiency, and natural resources/environmental compatibility.

ARTICLE 3 – AUTHORITIES

The primary purpose of NASAO is to foster and encourage cooperation and mutual aid among the states as well as Federal and local governments in the development of state and national air transportation systems that will be responsive to the regional, state, and national needs. By coordinating the various state laws, regulations, and programs with those of the

Responsible Organization(s)	Task	Target Date
FAA, NASAO, USDA	Develop talking points regarding the importance of strike reporting and conducting WHAs for state conferences.	December 2013
NASAO, USDA	Provide outreach materials at 100% of state conferences.	Through end of Calendar Year 2014
FAA	Send over 5,000 new wildlife strike awareness posters to NASAO state offices, non-certificated airports, and other aviation-related organizations.	December 2013
FAA, USDA	Task USDA to update study on strike reporting to follow up the study issued in 2009.	July 2014
NASAO	Contact the 168 general aviation airports in Group I and encourage them to conduct WHAs.	April 2014
NASAO, FAA, USDA	Hold quarterly telecons.	September 2013, January 2014, April 2014, August 2014
NASAO, FAA, USDA	Create action plan for Fiscal Year 2015.	August 2014

3. This MOU in no way restricts USDA APHIS or the organizations from participating in similar activities with other public or private agencies, organizations, and individuals.

4. In collaborative activities and programs, USDA APHIS and the organizations will recognize cooperative efforts by displaying each other's logos in a manner that is approved by the principle contacts of each party.

5. This MOU is neither a fiscal nor a funds obligation document. Any endeavor involving reimbursement or contribution funds between the parties to this MOU will be handled in accordance with applicable laws, regulations, and procedures including those for government procurement and printing. Such endeavors will be outlined in separate agreements that will be made in writing by representatives of the parties and will be independently authorized by appropriate statutory authority. The signing of this MOU does not provide or create such authority.

ARTICLE 11 - AMENDMENTS

This MOU may be amended at any time by mutual agreement of the parties in writing.

ARTICLE 12 - TERMINATION

This MOU may be terminated by any party upon 60 days' written notice to the other party.

ARTICLE 13 - EFFECTIVE DATE AND DURATION

This MOU will be in effect upon the date of final signatures and will continue to be in effect for 5 years or until terminated by any party.

Thomas M. Booth, Jr., 2013 Chairman — Date
National Association of State Aviation Officials

Michael P. Huerta, Administrator — 20 September 2013
Federal Aviation Administration

Kevin A. Shea, Administrator — 9/20/13
United States Department of Agriculture,
Animal and Plant Health Inspection Service

Appendix D. Boire Fields State Deer/Turkey Permit

New Hampshire
Fish and Game Department

11 Hazen Drive, Concord, NH 03301-6500
Headquarters: (603) 271-3421
Web site: www.WildNH.com

TDD Access: Relay NH 1-800-735-2964
FAX (603) 271-1438
E-mail: info@wildlife.nh.gov

Glenn Normandeau
Executive Director

November 13, 2012

TO WHOM IT MAY CONCERN:

Under the authority contained in RSA 207:26, permission is hereby granted to the Nashua Airport/Boire Field to shoot deer and turkey that pose a potential human health and safety hazard to aviation by their presence on or near the runways.

The agents for this authorization will be designated by the current air field safety personnel and should have sufficient firearm training to execute deer and turkey damage control.

The conditions of this shooting permit are as follows:

1. A total of five deer and five turkeys may be taken with this permit annually. This permit will in effect from the date of issue unless revoked by the NH Fish & Game Department. Deer and turkeys taken under the conditions of this permit will be disposed of at the discretion of the Director or his agent. RSA 207:29

2. Deer may be taken day or night. Deer and turkey kills shall be reported to Christopher Brison, or Lieutenant James Juneau at (271-3361) within twelve hours. RSA 207:27;28

3. Deer and turkeys may only be taken on or in the area immediately adjacent to the runways.

4. A summary report of animals taken shall be required annually at the close of the current calendar year (Dec 31). A negative report is required. Please send this report to the USDA/Widlife Services, 59 Chenell Drive 11 Hazen Drive, Concord, NH 03301 Att. Wildlife Damage Specialist.

Glenn Normandeau
Executive Director

cc: CO Christopher Brison
Lt. James Juneau
Mark Ellingwood

Conserving New Hampshire's wildlife and their habitats since 1865.

Appendix E. State of New Hampshire Fish and Game Laws and Rules

State of New Hampshire Laws and Rules

New Hampshire Code of Administrative Rules
Fish and Game Rules

Fis 304.07 Wildlife Depredation Permits for Airports.

(a) Agents involved in wildlife depredation shall be designated by the current airport administrator.

(b) The species and number of animals allowed to be taken shall be determined by the executive director or his staff.

(c) Animals taken under this permit shall be reported to the local fish and game conservation officer within 24 hours by calling 271 - 3361 between the hours of 8 am and 4:30 pm.

(d) Wildlife shall be allocated as provided in RSA 207:29.

Source. #7881, eff 4-26-03; ss by #9405, eff 3-7-09

TITLE XVIII
FISH AND GAME
CHAPTER 207
GENERAL PROVISIONS AS TO FISH AND GAME
Wildlife Damage Control
Section 207:26

207:26 Killing by Land Owner of Bird or Animal Inflicting Damage. – A person may pursue, wound or kill, on land owned or occupied by such person, any unprotected bird or wild animal which the person finds in the act of doing actual and substantial damage to poultry, crops, domestic animals, or the person's property, and may authorize a family member, employee, or other person requested to do so under the provision of a depredation permit issued by the executive director pursuant to RSA 207:22-c, III.
Source. 1935, 124:1. 1937, 188:6. RL 241:24. RSA 207:26. 1977, 247:13, eff. Aug. 19, 1977. 1999, 344:6, eff. Nov. 18, 1999.

Appendix F. Species of Special Concern in New Hampshire

Wildlife Species of Special Concern

NH Fish & Game Department
Nongame & Endangered Species Program

Definitions:

'Special Concern': Species of wildlife that are either 'Near-threatened species' (Category A) or 'Responsibility Species' (Category B).

Category A: 'Near-threatened Species': Species that could become Threatened in the foreseeable future if action is not taken.

Sub-category 1) Existing threats are such that the species could decline to threatened status if conservation actions are not taken. In some cases, further survey work may support removing a species from the 'special concern' list but existing information must indicate a sufficient level of threat or concern.

Sub-category 2) Species which were recently down-listed (i.e. recovered) from the state endangered and threatened species list and where conservation action is desired to ensure the species continues towards full recovery.

Category B: 'Responsibility Species': Species for which a large portion of their global or regional range (or population) occurs in New Hampshire and where actions to protect these species habitat will benefit the species' global population. Species were candidates for being included as Category B if they scored as 'Very High' (>8% of species Northeast range occurs in New Hampshire) in the Species Responsibility vs. Threat Matrix (Hunt 2007) or in subsequent analyses using similar methodologies.

Purpose/Uses of Special Concern List:

The NH wildlife 'Special Concern' list is intended to help prioritize, in addition to other tools such as the Endangered & Threatened wildlife list, conservation actions for wildlife. A few uses of the list include:

- The list is a tool for prioritizing research needs and conservation actions of wildlife species.
- The presence of 'Special Concern' species in a particular area may enhance grant application competitiveness for land acquisition.
- The presence of 'Special Concern' species should be considered when making habitat management decisions, especially on conservation parcels.
- The list is a tool for identifying species that need additional data collected in order to evaluate whether species should be listed as endangered or threatened in future or removed from the Special Concern list.
- List identifies species that need tracking because they have recently been delisted from the NH Endangered & Threatened species (NHFG FIS 1000) list due to recovery.

- Species listed on the Special Concern list are candidates for consideration in environmental review through the DES Wetlands Bureau Dredge & Fill Rules (Env-Wt 302.04 (7a) which require applicants to address impacts to Special Concern Wildlife. (Note: Including a species as 'Special Concern' does not automatically result in the species being included in Environmental Review at NHFG).

Special Concern Revision Process (2009 Revision):

Special Concern species were proposed during the 2008 Endangered & Threatened Species (NHFG FIS 1000) revision process which included a technical review by taxonomic experts. Once the Endangered & Threatened species list was finalized during September 2008, the Wildlife Action Plan Implementation Team (WAPIT) discussed the Special Concern list, made a few modifications based on expert review, and voted on the final list. Members of WAPIT included: John Kanter (NHFG-Wildlife Division), Charlie Bridges (NHFG-Wildlife Division), Mike Marchand (NHFG-Wildlife Division), Steve Fuller (NHFG-Wildlife Division), Emily Brunkhurst (NHFG-Wildlife Division), Matt Carpenter (NHFG-Fisheries Division), Ben Nugent (NHFG- Fisheries Division), Pam Hunt (NH Audubon), Jeff Tash (NH Natural Heritage Bureau), and Matt Tarr (UNH Cooperative Extension Wildlife Specialist).

Process to Update List:

The Special Concern list will be evaluated and updated no longer than 5 years between revisions. Species of wildlife may be proposed for listing or delisting at any time but a strong justification must be provided and an analysis must be conducted similar to what was completed for other species in Hunt 2007. New proposals for listing or delisting should be submitted to the NH Nongame & Endangered Species Coordinator. The Nongame & Endangered Species Coordinator, in consultation with biological staff at NH Fish & Game and the Wildlife Action Plan Implementation Team (WAPIT) will decide whether a revision is warranted. Revisions to the list will be documented by date.

Hunt, P. 2007. Endangered & Threatened Species List Revision Summaries including Species Threat x Responsibility Table. New Hampshire Audubon. Prepared under contract for the NH Fish & Game Department.

NH Wildlife - Special Concern List

Mussels

Common Name	Scientific Name	Category	Overview of Rationale
Eastern Pondmussel	*Ligumia nasuta*	A1	Limited distribution in NH where lake management and shoreline development is intense. Northeast Regional Conservation Concern.

Insects

Common Name	Scientific Name	Category	Overview of Rationale
Sleepy Duskywing	*Erynnis brizo brizo*	A1	This species is widespread across much of the U.S, although appears to be in decline in eastern portions of range. As an indicator species of pine barrens habitat it warrants conservation status. Identified as species of conservation concern in a review of rare shrubland Lepidoptera of New England (Wagner et al. 2003). Warrants SC status as an indicator species of pine barrens, larvae feed on scrub oak and black oak.
Barrens itame	*Itame sp. 1*	A1	Identified as species of conservation concern in a review of rare shrubland Lepidoptera of New England (Wagner et al. 2003). Warrants SC status as an indicator of high quality pitch pine barrens, believed to feed on scrub oak or lowbush blueberry. Although trends are largely unknown, this species is likely less common than historically due to loss and alteration of preferred habitats. As a northeastern endemic with absence and scarcity across its range, it warrants conservation. Has been identified at four locations in recent surveys.
Barrens xylotype	*Xylotype capax*	A1	Identified as species of conservation concern in a review of rare shrubland Lepidoptera of New England (Wagner et al. 2003). Although trends are largely unknown, this species is likely less common than historically due to loss and alteration of preferred habitats. Warrants SC status as an indicator species of pine barrens, larvae feed on either scrub oak or blueberry. Has been identified at four locations in recent surveys.
Broad-lined catopyrrha	*Erastria coloraria*	A1	Identified as species of conservation concern in a review of rare shrubland Lepidoptera of New England (Wagner et al. 2003). Warrants SC status as an indicator species of pine barrens. The host plant of this species is New Jersey tea, a shrub associated with pine barrens which has suffered substantial decline. Most recent record for this species is from 1994. Available data suggest this species may no longer occur in the state, but in the absence of regular surveys it should remain a conservation priority until its status is better known.

Cora moth (bird dropping moth)	*Cerma cora*	A1	Identified as species of conservation concern in a review of rare shrubland Lepidoptera of New England (Wagner et al. 2003). Warrants SC status as an indicator of high quality pitch pine barrens, rare throughout most of its range. Has been identified at two locations in recent surveys.
Phyllira tiger moth	*Grammia phyllira*	A1	Sandy grassland specialist found within pine barren habitat. Lepidoptera require habitat conditions that result from fire or similar natural disturbance. In the absence of disturbance - and with increasing fragmentation - their populations may not be self-sustaining. Documented food source includes lupine, although may not be the only native food source. Has been identified at two locations in recent surveys
Pine barrens zanclognatha moth	*Zanclognatha martha*	A1	Identified as species of conservation concern in a review of rare shrubland Lepidoptera of New England (Wagner et al. 2003). Recent surveys have found this species to be present in appropriate habitat in New Hampshire, but still endemic to pine barrens warranting SC status as an indicator species. Has been identified at 10-15 locations statewide during recent surveys.
Scarlet Bluet	*Enallagma pictum*	B	Regional endemic. NH has relatively high responsibility with at least 22 sites.
Pine Barrens Bluet	*Enallagma recurvatum*	A1	Regional endemic. Only one known site in NH (but likely overlooked). If other sites exist, they are likely in the rapidly developing southeastern portion of the state.
Rapids Clubtail	*Gomphus quadricolor*	A1	Only known from 3-4 sites in NH, where it appears rare. Species of regional concern. Recently listed as Endangered in Canada (at northern edge of range).
Skillet Clubtail	*Gomphus ventricosus*	A1	Only known from 3-4 sites in NH, where it appears rare. As a species of large rivers (Connecticut and Merrimack), it is at risk from river-related threats.
Riverine Clubtail	*Stylurus amnicola*	A1	Restricted to lower stretches of Connecticut and Merrimack rivers, where uncommon.
Coppery Emerald	*Somatochlora georgiana*	A1B	Endemic subpopulation in southeastern New England. Single known site in NH is protected, but if others occur they would likely be in rapidly developing area of state.
Ebony Boghaunter	*Williamsonia fletcheri*	B	High responsibility but found at increasing number of sites.

Fishes

Common Name	Scientific Name	Category	Overview of Rationale
Alewife (sea run only)	*Alosa psuedoharengus*	A1	Declines in most populations, limited access to historical spawning habitat.
American Eel	*Anguilla rostrata*	A1	Declines in most populations, limited access to historical spawning habitat.
American Shad	*Alosa sapidissima*	A1	Declines in most populations, limited access to historical spawning habitat.
Blueback Herring	*Alosa aestivalis*	A1	Declines in most populations, limited access to historical spawning habitat.
Rainbow Smelt (sea run only)	*Osmerus mordax*	A1	Access to historical spawning habitat restricted by undersized culverts and dams. Spawning habitat vulnerable to sedimentation and pollution.

Sea Lamprey	*Petromyzon marinus*	A1	Declines in most populations, limited access to historical spawning habitat.
Banded Sunfish	*Enneacanthus obesus*	A1B	Northeast Regional Conservation Concern. NH distribution overlaps the rapidly developing southern part of the state. Highly dependent on intact, vegetated shoreline habitat, which is impacted by shorefront development.
Finescale Dace	*Phoxinus neogaeus*	A1	Lentic populations vulnerable to introduced littoral predators and artificial water level fluctuations.
Lake Whitefish	*Coregonus clupeaformis*	A1	Spawning habitat vulnerable to artificial water level fluctuation and sedimentation.
Northern Redbelly Dace	*Phoxinus eos*	A1	Lentic populations vulnerable to introduced littoral predators and artificial water level fluctuations.
Redfin Pickerel	*Esox americanus americanus*	A1	NH distribution overlaps the rapidly developing southern part of the state. Highly dependent on intact, vegetated shoreline habitat, which is impacted by shorefront development
Round Whitefish		A1B	Considered for Endangered during 2008 revision. Northeast Regional Conservation Concern. Spawning habitat vulnerable to artificial water level fluctuation and sedimentation. Documented extirpations in water bodies with introduced littoral predators.
Swamp Darter	*Etheostoma fusiforme*	A1	NH distribution overlaps the rapidly developing southern part of the state. Vulnerable to habitat fragmentation.

Amphibians

Common Name	Scientific Name	Category	Overview of Rationale
Jefferson Salamander	*Ambystoma jeffersonianum*	A1	Extremely limited range in state and habitat at risk. Difficulty in distinguishing this species from Blue-spotted Salamander argues for SC status for the complex rather than different categories for the two species. Northeast Regional Conservation Concern.
Blue-spotted Salamander	*Ambystoma laterale*	A1	Widely distributed in New Hampshire but available data indicates much less common than spotted salamanders and habitat vulnerable to conversion. Difficulty in distinguishing this species from Jefferson salamander argues for SC status for the complex rather than different categories for the two species. Northeast Regional Conservation Concern.
Fowler's Toad	*Anaxyrus fowleri (formerly Bufo)*	A1	Only several known sites in NH. Associated with sandy soils in southern NH which are most vulnerable to development.
Northern Leopard Frog	*Lithobates pipiens (formerly Rana)*	A1	Limited occurrences currently known. Populations in vulnerable habitats. Northeast Regional Conservation Concern.

Reptiles

Common Name	Scientific Name	Category	Overview of Rationale
Wood Turtle	*Glyptemys insculpta (formerly Clemmys)*	A1	High risk in much of southern NH. Vulnerable to development, collection, roads, stream alterations and life history traits. Northeast Regional Conservation Concern.
Eastern Box Turtle	*Terrapene carolina*	A1	Only a few records of individual turtles in southern NH. Habitat extremely vulnerable to conversion. Northeast Regional Conservation Concern.

Smooth Green Snake	*Opheodrys vernalis*	A1	Anecdotal long-term declines in species. Declines in primary habitat used and sensitive to pesticides.

Birds

Common Name	Scientific Name	Category	Overview of Rationale
Spruce Grouse	*Falcipennis canadensis*	A1	Species was removed from SC list in the previous revision, but retained on list of SGCN for WAP. Although NH populations appear stable, potential habitat shifts resulting from climate change are an important threat, and the Spruce Grouse should be considered SC in light of this risk.
Least Bittern	*Ixobrychus exilis*	A1	Only reliable location in NH is the extensive marshes along the Connecticut River in Hinsdale. Listed as endangered in Massachusetts and Maine, where it is similarly rare and local in distribution.
Osprey	*Pandion haliaetus*	A2	Osprey was removed from "threatened" status because of significant population recovery and ranger expansion in the state. It is retained as SC to facilitate continued recovery.
American Kestrel	*Falco sparverius*	A1	Consistent population declines and range retraction throughout the region
Sora	*Porzana carolina*	A1	Available data suggest that Soras are much rarer in NH than during the first Breeding Bird Atlas. Also suspected to be declining regionally.
Common Moorhen	*Gallinula chloropus*	A1	Remains the rarest of the regularly occurring marsh birds in NH, with no breeding noted since the Breeding Bird Atlas in the early 1980s. Sites occupied at that time are have not been used in recent years, and there are very few breeding season records of any kind.
Willet	*Tringa semipalmata*	A1	Limited habitat at risk from climate change and development.
Arctic Tern	*Sterna paradisaea*	A1	Restricted to single colony reliant on management, but NH at extreme southern edge of species' range and it will likely never be common in the state. Retain on list to ensure continued recovery. Also declining overall in Gulf of Maine.
Whip-poor-will	*Caprimulgus vociferus*	A1	Declining across region and of concern in all northeastern states. Northeast Regional Conservation Concern.
Olive-sided Flycatcher	*Contopus cooperi*	A1	Consistent population declines and range retractions. NH population declining at -7.5% per year. Recently listed as Threatened in Canada.
Horned Lark	*Eremophila alpestris*	A1	May only occur at 6-7 sites in state, all of which are airports. Historically occurred in Hampton/Seabrook dunes, but no recent data.
Purple Martin	*Progne subis*	A1	New Hampshire population has experienced significant declines, but major limiting factor may be extreme weather events rather than loss of habitat or other manageable threats. Entirely reliant on human-provided housing for breeding. Because of declines and rarity, worth retaining as SC.
Bank Swallow	*Riparia riparia*	A1	Consistent population declines and range retraction throughout the region.. Considered for threatened status in Canada.

Cliff Swallow	*Petrochelidon pyrrhonota*	A1	Dramatic loss of colonies in NH, with many former colonies now unoccupied. NH population declining at -7.5% per year. Declining elsewhere in Region, but usually not as strongly.
Bicknell's Thrush	*Catharus bicknelli*	B	Regional endemic. NH holds over 30% of global habitat, much of it high quality. Northeast Regional Conservation Concern.
American Pipit	*Anthus rubescens*	A1B	Isolated population of ~15 pairs in Presidential Range. One of only 3-4 such sites in the Northeast.
Golden-winged Warbler	*Vermivora chrysoptera*	A1	Probably extirpated from NH in last decade. A species of continental concern. Northeast Regional Conservation Concern.
Cerulean Warbler	*Dendroica cerulea*	A1	Only reliable location in state is Pawtuckaway SP, where less than 5 pairs breed. A species of continental concern. Northeast Regional Conservation Concern.
Vesper Sparrow	*Pooecetes gramineus*	A1	Significant declines. Now only known from fewer than 20 sites statewide.
Nelson's Sharp-tailed Sparrow	*Ammodramus nelsoni*	A1	Limited habitat at risk from climate change and development
Saltmarsh Sharp-tailed Sparrow	*Ammodramus caudacutus*	A1	Limited habitat at risk from climate change and development. Regional endemic considered vulnerable at global scale. Northeast Regional Conservation Concern.
Seaside Sparrow	*Ammodramus maritimus*	A1	Limited habitat at risk from climate change and development. Very rare in NH and may not be present in all years.
Eastern Meadowlark	*Sturnella magna*	A1	State and regional population declines (NH -5.8% per year). Appears to have disappeared from many formerly occupied areas, especially from the Lakes Region north.
Rusty Blackbird	*Euphagus carolinus*	A1	Species of high regional and continental concern due to population declines. Limited data suggest absence from many formerly occupied sites in NH.

Mammals

Common Name	Scientific Name	Category	Overview of Rationale
Eastern Red Bat	*Lasiurus borealis*	A1	Lack of information on population status in combination with high risks from wind power as they congregate during migration. Also at risk from some logging practices that may harm some maternity roosts. Northeast Regional Conservation Concern.
Hoary Bat	*Lasiurus cinereus*	A1	Lack of information on population status in combination with high risks from wind power as they congregate during migration. Also at risk from some logging practices that may harm maternity roosts. Northeast Regional Conservation Concern.
Silver-haired Bat	*Lasionycteris noctivagans*	A1	Lack of information on population status in combination with high risks from wind power and some logging practices may harm maternity roosts which are preferentially in old growth forests. Northeast Regional Conservation Concern.

Northern long-ear bat	*Myotis septentrionalis*	A1	Prefer smaller winter hibernacula in NH, which are not protected from disturbance, and populations at the two largest have decreased. Susceptible to White Nose Syndrome. Summer roosts threatened by forest fragmentation.
Eastern Pipistrelle changed to Tricolored bat	*Pipistrellus subfalvus* changed to *Perimyotis subflavus*	A1	These bats are known from few sites in NH. Winter hibernacula are threatened by disturbance and White Nose Syndrome. Strong fidelity to summer roosts means forestry operations can have larger impact.
Northern Bog Lemming	*Synaptomys borealis sphagnicola*	A1	Only a few records known despite surveys in potential habitat. Northeast Regional Conservation Concern.

Appendix G. CertAlert No. 04-16, Deer Hazard to Aircraft and Deer Fencing

C E R T A L E R T

ADVISORY CAUTIONARY NON-DIRECTIVE
AIRPORT SAFETY AND OPERATIONS DIVISION AAS-300

FOR INFORMATION, CONTACT Ed Cleary, (202) 267-3389, AAS-300 (202) 267-3389

Date: **12/13/2004** **No. 04-16**

To: **Airport Operators, FAA Airport Certification Safety Inspectors**

Topic: **Deer Hazard to Aircraft and Deer Fencing**

CANCELLATION:

Certalert 01-01. Deer Aircraft Hazard, dated February 1, 2001; and Certalert 02-09. Alternative Deer Fencing, dated December 12, 2002, are cancelled.

BACKGROUND

Elevated deer populations in the United States represent an increasingly serious threat to both Commercial and General Aviation Aircraft. It is currently estimated that there over 26 million deer in the United States. Because of increasing urbanization and rapidly expanding deer populations, deer are adapting to human environments, especially around airports, where they often find food and shelter. From 1990 to 2004, over 650 deer-aircraft collisions were reported to the Federal Aviation Administration (FAA). Of these reports, over 500 indicated the aircraft was damaged as a result of the collision.

In light of recent incidents where a Learjet landing at an airport in Alabama and a Learjet departing an airport in Oregon were destroyed after colliding with deer or elk, airport operators are reminded of the importance of controlling deer and other wild ungulates on and around airfields.

PURPOSE

Proper fencing is the best way of keeping deer off aircraft movement areas. The FAA recommends a 10-12 foot chain link fence with 3-strand barbed wire outriggers. In some cases

an airport may be able to use an 8-foot chain link fence with 3-strand barbed outriggers, depending upon the amount of deer activity in a local area.

All fencing must be properly installed and maintained. A 4-foot skirt of chain-link fence material, attached to the bottom of the fence and buried at a 45^{o} angle on the outside of the fence will prevent animals from digging under the fence and reduce the chance of washouts. This type of fencing also greatly increases airport security and safety. The fence line right-of-way must be kept free of excess vegetation. The fence line should be patrolled at least daily, and any washouts, breaks or other holes in the fence repaired as soon as they are discovered.

Gates should close with less than 6-inch gaps to prevent entry by deer.

When installation of chain link fencing is not feasible due to cost or environmental impacts, other types of fencing may be installed. (Cost alone is not an acceptable reason for rejecting the use of chain link fencing.) In some cases, electric fencing may offer a suitable alternative. Recent improvements in fencing components and design have greatly increased the effectiveness and ease of installation of electric fences. Tests by the USDA, National Wildlife Research Center have shown that some 4 to 6-foot, 5 to 9-strand electric fences designs can be 99% effective at stopping deer. Installation of some of the newer electric fences requires neither specialized equipment nor training and can be accomplished by airport personnel.

In limited situations, the use of non-conductive, composite, frangible electric fence posts and fence conductors may allow the installation of electric fence closer to the aircraft movement area than would normally be allowed with standard chain link fencing material.

If deer are observed on or near the aircraft movement area, immediate action must be taken to remove them.

Airport operators can contact the nearest USDA, Wildlife Services Office or the State Wildlife Management Agency for assistance with deer problems.

December 13, 2004

Ben Castellano, Manager
Airport Safety & Operations Division

Date

Appendix H. Wildlife Management Equipment Suppliers

Metal wires, projections, or netting

Bird-B-Gone – Mission Viejo, CA	1-800-392-6915	www.birdbgone.com
Bird Barrier – Secaucus, NJ	1-800-503-5444	www.birdbarrier.com
Bird-X, Inc. – Chicago, IL	1-800-860-0473	www.bird-x.com
Cat Claw Inc. – Johnstown, PA	1-814-266-5544	www.catclaw.com
Hot Foot America – Sausalito, CA	1-800-533-8421	www.hotfoot.com
J.A. Cissel Mfg. Co – Lakewood, NJ	1-800-631-2234	www.jacissel.net
Nixalite of America – East Moline, IL	1-888-624-1189	www.nixalite.com
Nylon Net Co. – Memphis, TN	1-800-238-7529	www.nylonnet.com
Sutton Ag Enterprises – Salinas, CA	1-800-422-9693	www.suttonag.com
Wildlife Control Supplies – Granby, CT	1-860-844-0101	www.wildlifecontrolsupplies.com
Wildlife Control Technology, Inc – Fresno, CA	1-800-235-0262	www.wildlife-control.com

Tactile repellents

Bird-X, Inc. – Chicago, IL	1-800-860-0473	www.bird-x.com
Hot Foot America – Sausalito, CA	1-800-533-8421	www.hotfoot.com
J.T. Eaton – Twinsburg, OH	1-800-321-3421	www.jteaton.com
Nixalite of America – East Moline, IL	1-888-624-1189	www.nixalite.com
Sutton Ag Enterprises – Salinas, CA	1-800-422-9693	www.suttonag.com
Wildlife Control Supplies – Granby, CT	1-860-844-0101	www.wildlifecontrolsupplies.com

Propane exploder

Reed-Joseph International – Greenville, MS	1-800-647-5554	www.reedjoseph.com
Margo Supplies, Ltd. – Alberta, Canada	1-403-652-1932	www.margosupplies.com

Pyrotechnic devices

All Purpose Ammo – Seneca, SC	1-800-870-2666	
APGAR, Inc. – Bedford Hills, NY	1-914-666-5774	
Reed-Joseph International – Greenville, MS	1-800-647-5554	www.reedjoseph.com
Margo Supplies, Ltd. – Alberta, Canada	1-403-652-1932	www.margosupplies.com
Sutton Ag Enterprises – Salinas, CA	1-800-422-9693	www.suttonag.com
Wildlife Control Supplies – Granby, CT	1-860-844-0101	www.wildlifecontrolsupplies.com
Wildlife Control Technology, Inc – Fresno, CA	1-800-235-0262	www.wildlife-control.com

Traps and trapping supplies

Bird Barrier – Secaucus, NJ	1-800-503-5444	www.birdbarrier.com
Forestry Suppliers, Inc. – Jackson, MS	1-800-647-5368	www.forestry-suppliers.com
Ketch-All Company – San Luis Obispo, CA	1-805-543-7223	www.ketch-all.com
M & M Fur Company – Bridgewater, SD	1-605-729-2535	
Minnesota Trapline Products – Pennock, MN	1-320-599-4176	www.minntrapprod.com

Appendix I. New Hampshire Endangered and Threatened Species

ENDANGERED AND THREATENED
Wildlife of New Hampshire

ENDANGERED

Endangered wildlife are those native species that are in danger of extinction in New Hampshire because of a loss or change in habitat, over-exploitation, predation, competition, disease, disturbance or contamination. Assistance is needed to ensure these species' continued existence as viable members of the state's wildlife community.

INVERTEBRATES
Dwarf wedge mussel, *Alasmidonta heterodon***
Brook floater mussel, *Alasmidonta varicosa*
Ringed boghaunter, *Williamsonia lintneri*
Cobblestone tiger beetle, *Cicindela marginipennis*
Puritan tiger beetle, *Cicindela puritana**
Frosted elfin butterfly, *Callophrys irus*
Karner blue butterfly, *Lycaeides melissa samuelis***
White Mountain fritillary, *Boloria titania montinus*
Persius duskywing skipper, *Erynnis persius*

FISH
American brook lamprey, *Lethenteron appendix*
Shortnose sturgeon, *Acipenser brevirostrum***

REPTILES
Blanding's turtle, *Emydoidea blandingii*
Eastern hognose snake, *Heterodon platirhinos*
Timber rattlesnake, *Crotalus horridus*

AMPHIBIANS
Marbled salamander, *Ambystoma opacum*

BIRDS
Northern harrier, *Circus cyaneus*
Golden eagle, *Aquila chrysaetos*
Common nighthawk, *Chordeiles minor*
Piping plover, *Charadrius melodus**
Upland sandpiper, *Bartramia longicauda*
Roseate tern, *Sterna dougallii***
Least tern, *Sterna antillarum*
Sedge wren, *Cistothorus platensis*

MAMMALS
Small-footed bat, *Myotis leibii*
New England cottontail, *Sylvilagus transitionalis*
Canada lynx, *Lynx canadensis**
Gray wolf, *Canis lupus***

* Federally Threatened ** Federally Endangered

THREATENED

Threatened wildlife are those native species that are likely to become endangered in the near future, if conditions surrounding them begin, or continue, to decline.

INVERTEBRATES
Pine pinion moth, *Lithophane lepida lepida*
White Mountain arctic, *Oeneis melissa semidea*

FISH
Bridle shiner, *Notropis bifrenatus*

REPTILES
Spotted turtle, *Clemmys guttata*
Black racer, *Coluber constrictor*

AMPHIBIANS (none)

BIRDS
Pied-billed grebe, *Podilymbus podiceps*
Common loon, *Gavia immer*
Bald eagle, *Haliaeetus leucocephalus*
Peregrine falcon, *Falco peregrinus*
Common tern, *Sterna hirundo*
American three-toed woodpecker, *Picoides dorsalis*
Grasshopper sparrow, *Ammodramus savannarum*

MAMMALS
American marten, *Martes americana*

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