Fall 2005 Daytime Avian Foraging Survey Report for the Kibby Wind Power Project

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November 2006

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1.0 INTRODUCTION

1.1 Project Context

TransCanada Energy Ltd. (TransCanada) is proposing to develop, own and operate a 100–200 megawatt (MW) wind power generating facility on 3,700 acres in the Boundary Mountains of Western Maine known as the Kibby Wind Power Project. The project is in a location for which a similar project proposal by U.S. Windpower was previously approved by the Land Use Regulation Commission (LURC). TransCanada intends to utilize existing information from that licensing effort and conduct additional baseline studies to appropriately determine the level of potential impact associated with the project.

The project will be located in an unincorporated area of Franklin County, Maine. Turbine locations are anticipated to be established along four ridgelines within the project area, as shown in Figure 1. The property is owned by Plum Creek and the surrounding areas are currently actively managed for forest products. The Kibby Wind Power Project can take advantage of existing logging roads and cleared areas to access the ridgelines, and forestry activities can continue with the project in place. The project will utilize the superior wind resource found in this vicinity to create clean, renewable power generation. TransCanada is committed to siting and designing the facilities to minimize environmental and community impacts to the extent possible.

As part of pre-construction analyses for the Kibby Wind Power Project, several studies will be conducted to assist in determining which avian species occur in the project area, and to document areas of occurrence. These studies include daytime migration surveys, nighttime radar surveys, and daytime avian foraging surveys. The first surveys were performed in the fall of 2005; additional surveys are planned for spring and fall of 2006. This report focuses on the findings of daytime avian foraging surveys conducted in the fall of 2005.

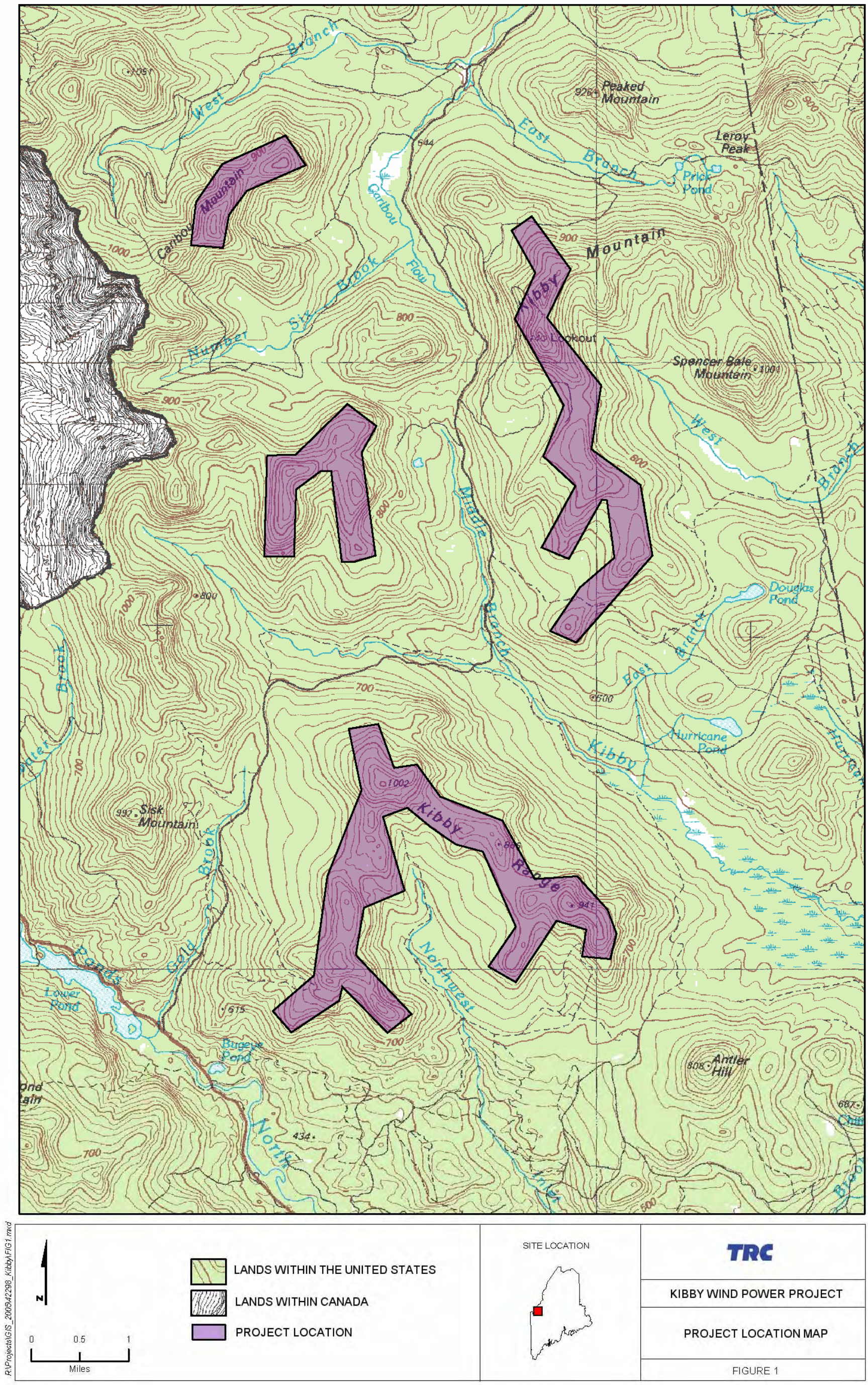
Daytime avian foraging surveys (foraging surveys) are intended to supplement nighttime radar surveys regarding migrant species occurrence in the project area vicinity. The radar studies quantify passage rates of night-time migrants through the project area, but cannot distinguish taxonomic classifications of the migrants. Daytime surveys were performed to augment the radar data and to determine what species occur in the project area during fall migration.

1.2 Project Area Description

The project area is located in the Boundary Mountains of western Maine, in Franklin County. It is within the Western Mountains Biophysical Region of Maine, which borders northern New Hampshire and Quebec, Canada.

The Western Mountains Biophysical Region is best characterized by its rugged topography, cool climate, low annual precipitation, and high snowfall. The average maximum temperature in July is approximately 24ºC (75ºF), which is lower than any other part of the state except the Eastern Coastal Region. The average minimum temperature in January is -18ºC (-1ºF), comparable to that of northern Maine. The average annual precipitation in this region is low, at approximately

Figure 1: Project Location



15 centimeters (cm) (6 inches [in]) although this varies with elevation and aspect. Due to the rain shadow effect that mountains and mountain ranges produce, windward slopes may receive up to 20 cm (8 in) of annual precipitation while leeward slopes may receive less than 14 cm (5.5 in) (McMahon 1990).

The predominant peaks in the project vicinity include Smart, Caribou, Kibby, Tumbledown, Spencer Bale and Sisk mountains, all of which are over 975 meters (m) (3,199 feet [ft]) high. Caribou and Kibby mountains are the tallest of these mountains, at 1,051 m (3,448 ft) and 1,115 m (3,658 ft), respectively, and are both included as potential wind turbine development areas of the project. Kibby Range is the largest of the mountain ranges in the project area, in terms of area and number of peaks included within ridgelines, and has several peaks that are approximately 915 m to 1,000 m (3,002 ft to 3,281 ft) high. The valley bottoms in the study area average between 650 m and 750 m (2,133 ft and 2,461 ft) in elevation. Gold Brook drains the southwestern portion of the project area southward, to the North Branch of the Dead River. Kibby Stream and Spencer Stream drain the central and eastern parts of the project area eastward, to the Dead River. The headwaters of the Moose River drain the northern parts of the project area.

Soils within the project area are generally cool, shallow, and well drained at elevations above 762 m (2,500 ft). The ridge tops are made up of shallow Saddleback soils while deeper Enchanted soils occur on upper slopes. Both of these soils are cryic and are characterized by a mean annual soil temperature between 0ºC and 8ºC (32ºF and 47ºF). Balsam fir (*Abies balsamea*) and red spruce (*Picea rubens*) are the dominant tree species along ridge tops above 762 m (2,500 ft). Sugar maple (*Acer saccharum*), yellow birch (*Betula alleghaniensis*), and American beech (*Fagus grandifolia*) are the dominant tree species in the valleys. Within the maple/birch/beech forests of the lower elevations within the project area, hobblebush (*Viburnum lantanoides*) is the most common woody shrub species. The project area is located within a working forest. Consequently, the dominant forest types are present in a variety of different ages and species composition. The road system in the area is well developed and forest harvesting activities within the last 12 years are fairly evenly distributed throughout the townships. Harvesting is generally limited to areas below 823 m (2,700 ft).

1.3 Objectives

The main objectives of fall 2005 foraging surveys were to:

- Identify resident and migrant species foraging in the project area; and
- Obtain a quantitative assessment of species composition, relative abundance, distribution, and spatial patterns of use by resident and migrating birds foraging during daytime hours in the vicinity the project location.

1.4 Prior Studies

U.S. Windpower conducted similar studies in the spring and fall of 1994 (ND&T 1995a and 1995b). Data collected during those prior studies are summarized in Section 4.1.1. Where appropriate, current data will be compared with data collected during these earlier studies in the report.

2.0 STUDY METHODOLOGY

2.1 Survey Protocol

Basic methodologies for 2005 daytime avian foraging bird surveys were similar to those performed during the fall of 1994 for U.S. Windpower (ND&T 1994a, 1994b, 1995a and 1995b). However, in 2005, a greater amount of effort was expended. Specifically, 4 transects were surveyed in 2005, as opposed to only 2 in 1994. These additional transects increased the overall units of effort ([length of transect] x [number of visits]) expended in 2005 (as compared to 1994). In 1994, 5 and 9 units of effort were expended on valley and ridge transects, respectively. In 2005, 17 and 12.15 units of effort were expended on the valley and ridge transects, respectively (detailed in Section 3.1.3.2, Table 5). This extra effort may have increased likelihood of observations of less-abundant species.

An interagency meeting with Maine Department of Inland Fisheries and Wildlife (MDIFW), United States Fish and Wildlife Service (USFWS), the Land Use Regulation Commission (LURC), Maine Department of Environmental Protection (MDEP), and the United States Army Corps of Engineers (USACE) was held August 18, 2005, to discuss proposed migration studies for the fall 2005. During this discussion, Mr. Thomas Hodgman, MDIFW Bird Group, recommended conducting morning foraging migrant studies and noted that the prior studies performed for U.S. Windpower were an appropriate model to follow. Subsequent to that meeting, a written study protocol was provided to Mr. Hodgman (see Appendix A). Written comments were submitted by Mr. Hodgman, August 30, 2005, which stated that the proposed protocol was adequate and that using Hawk Migration Association of North America (HMANA) and HawkWatch International standards for data collection were appreciated.

The surveys were performed by one observer walking slowly along a transect early in the morning of each of a total of nine survey days in the fall of 2005. All birds observed were identified to species (whenever possible), and distance from the transect was estimated and recorded. The behavior of each bird when first observed and foraging birds' locations (including where they were foraging, i.e., substrate: ground, shrubs, trees, etc.) were noted.

2.1.1 Survey Site Locations

Four survey transects were selected for fall 2005 foraging surveys (Figures 2 and 3). Each was mapped and its length calculated using Global Positioning System (GPS). Transects were selected largely based on adequate access, as well as being located in representative habitat for the area.

Two transects were located in valleys: one on the lower western slope of Kibby Range, and one on the lower western slope of Kibby Mountain. The Kibby Range valley transect was located along an abandoned logging road, between approximately 2,230 and 2,300 feet elevation. The Kibby Mountain valley transect was located along a jeep trail, between approximately 2,560 and 2,700 feet elevation.

Figure 2: Kibby Mountain Transect Locations

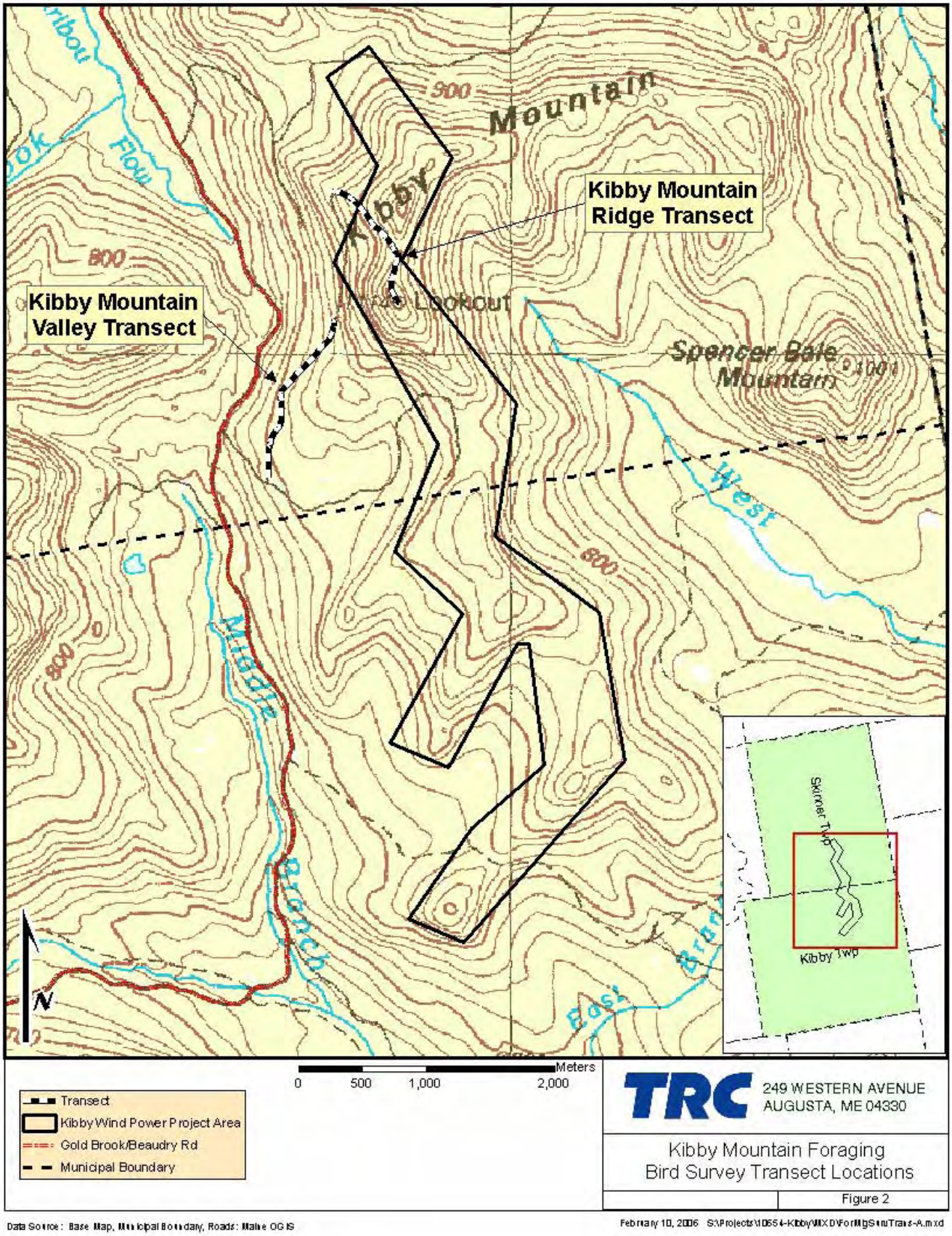
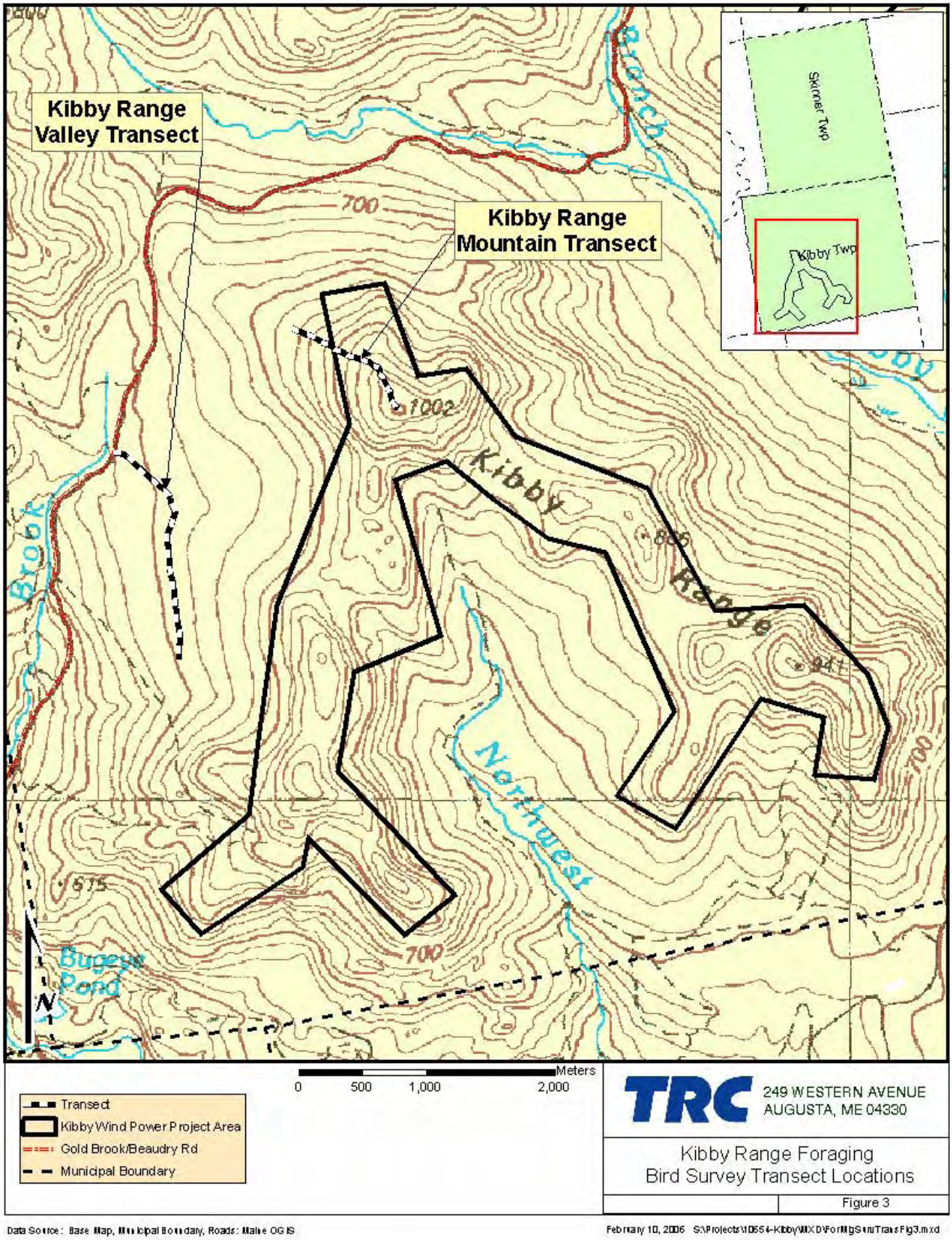


Figure 3: Kibby Ridge Transect Locations



Two transects were located on ridges: one on the northern ridge of Kibby Range, and one on the central ridge of Kibby Mountain. The Kibby Range ridge transect was located along a trail to the summit, between approximately 2,700 and 3,200 feet elevation. The Kibby Mountain ridge transect was located along a jeep trail, between approximately 3,140 and 3,654 feet elevation.

Habitat types were described qualitatively for each transect, based on vegetation community type. Descriptions were based on "Natural Landscapes of Maine: A Classification of Vegetated Natural Communities and Ecosystems" (Gawler and Cutko 2004).

2.1.2 Number and Timing of Surveys

Daytime avian foraging surveys typically began at dawn and ended before noon each day. Sampling was performed based upon favorable weather for bird observation. Surveys were not conducted during precipitation, in fog, on days that were overcast with low cloud cover, or during any other circumstances that hampered visibility or audibility. Some survey events were discontinued if unfavorable weather conditions developed over the course of the survey. Nine days of surveys were performed, seven in September and two in October. Twenty individual transects surveys were completed over these dates.

2.1.3 Surveyor Preparedness

For the daytime foraging surveys, surveyors were familiarized with the topography of the area (including habitat characteristics of each transect) prior to starting surveys. Each surveyor was trained in the methodology, and was expected to become familiar with the survey area and each transect prior to commencing surveys. Only persons experienced in bird identification performed these surveys.

2.1.4 Data Collection

Data collected during foraging surveys were entered directly onto a field data sheet designed specifically for this task (HMANA 2005, see Appendix B). The data collected included detailed weather information, as well as behavior and substrate information for each bird (or flock) observed. Additionally, incidental bird observations were recorded by biologists performing other tasks in the project area during this study period (fall migration). These incidental observations are reported herein, separately from data collected during foraging surveys.

2.1.4.1 Weather Observations

Weather conditions were noted at the beginning of each survey and hourly thereafter if changes occurred. These data were collected based on codes and protocol by HMANA, and were recorded directly onto observation data sheets. Parameters recorded included wind speed (estimated using Beaufort scale), wind direction (compass direction from which the wind is coming, or "variable"), temperature (degrees Celsius), relative humidity (as recorded daily for Berlin, New Hampshire), barometric pressure (as recorded daily for Berlin, New Hampshire), percent cloud cover (visually estimated by observer), visibility (distance estimated by observer

based on landmarks and topography of known distances from observation point), and precipitation (general descriptions, such as light mist, drizzle, etc.).

2.1.4.2 Individual Bird Observations

For each bird observed during foraging surveys, the following information was recorded: species, behavior when first observed (foraging, calling, flying, perching, other), substrate (ground, shrub/tree, deciduous/conifer/mixed, other), and estimated distance from the transect. Additional notes were recorded as warranted. Birds that flew over the transect were recorded at a distance of "0."

2.1.4.3 Flock Observations

Flock observations were treated in the same way as individual bird observations. Actual counts of the number of birds in the flock were performed when possible. Otherwise, estimates were made to the best of the surveyor's approximation.

2.1.4.4 Field Quality Assurance and Quality Control

Data sheets were reviewed for completeness, accuracy, and legibility prior to leaving the survey site. Incidental observation data were inspected at the end of each survey day. Any problems noted were rectified at that time; any changes to the data sheets were initialed by the person making the change (if other than the original observer).

2.2 Data Analysis

Data, as recorded in the field, were entered into and stored in a numerical database or spreadsheet format.

The following descriptive summaries of the data were generated to address the objectives and goals of this study:

- Species inventories and relative abundance;
- Distribution of habitat types by frequency of observation;
- Avian distribution patterns by species and habitat type; and
- Frequency of behaviors observed.

2.2.1 Shannon-Weiner Diversity Index and Equitability

Overall patterns in avian community diversity by site were characterized using both the Shannon-Weiner diversity index (H) and an assessment of community Equitability (J). Diversity is a mathematical expression of community structure, which varies with both species richness and equitability. For example, a community with many equally distributed species will exhibit high species diversity, whereas a community dominated by one or a few species will have low species diversity. The Shannon-Weiner diversity index is appropriate when dealing with a random sample and is represented by a single number that describes the diversity of a given community:

$$H = -\sum_{i=1}^{S} P_i \ln P_i$$

where:

P_i = the fraction of the total sample represented by species *i*;
$\ln P_i$ = is the natural log of the species fraction P_i; and
S = the total number of species (species richness).

Equitability is represented by J, whereby J is calculated as a proportion of the maximum possible value H would assume (H_{max}) if individuals were completely evenly distributed within the community ($H_{max} = \ln S$):

$$J = \frac{-\sum_{i=1}^{S} P_i \ln P_i}{\ln S}$$

2.2.2 Morisita Index of Similarity

The next step in the analysis of the avian community is to investigate exactly how diversity changes between sites by exploring the degree of species turnover, which is achieved by calculating a similarity index. Although a suite of similarity/dissimilarity indices exist, the Morisita Index of Similarity (Morisita, 1959) was selected for this analysis given its robust nature:

$$MS_{ij} = \frac{2\sum_{k=1}^{S} x_{ik} x_{jk}}{\left(\lambda_i + \lambda_j\right) N_i N_j}$$

where:

MS_{ij} = Morisita similarity index for samples i and j.
S = Number of total species.
x_{ik} = Abundance of species k in sample i:
x_{jk} = Abundance of species k in sample j.
N_i = Total individuals in sample i;
N_j = Total individuals in sample j.
λ_i, λ_j = Simpson's unbiased diversity estimator for samples i and j:

$$\lambda_i = \frac{\sum_{k=1}^{S} x_{ik}\left(x_{ik} - 1\right)}{N_i\left(N_i - 1\right)}$$

The Morisita similarity index ranges from 0 to slightly above 1.0, with a 0 value indicating complete dissimilarity and a value of 1.0 indicating complete similarity. The Morisita index is not affected by sample size.

2.2.3 Statistical Analysis

Statistically significant differences in Shannon-Weiner diversity indices between sites were assessed with a non-parametric, Mann-Whitney *U*-test (U_A), which examines paired differences in the ranks of the two samples. The values used in the comparison included the individual H values calculated for each species at each site. The significance of differences in the numbers of organisms between sites was rapidly evaluated with a simple χ^2 goodness-of-fit test. For the purposes of this analysis, the expected numbers of organisms by site were weighted by the average number of individuals/km (unit of effort).

3.0 RESULTS AND DISCUSSION

3.1 Daytime Avian Foraging Surveys

In all, 20 transect surveys were performed during the fall 2005 season. The dates and times on which each transect was visited are listed on Table 1, below.

Table 1: Dates and Times of 2005 Survey Events

Site	Date	Time	
		Valley	Ridge
Kibby Mountain	September 6	6:30 - 7:12	7:30 - 8:00
	September 11	8:03 - 8:37	8:53 - 9:22
	September 16	7:20 - 8:13	8:32 - 9:12
	September 21	11:15 - 12:30	12:45 - 1:30
	October 5	7:50 - 8:30	8:51 - 9:28
Kibby Range	September 7	6:40 - 8:00	9:00 - 10:00
	September 14	6:20 - 7:45	8:45 - 9:30
	September 21	9:00 - 10:00	7:30 - 8:30
	September 29	9:30 - 10:30	11:15 - 11:45
	October 6	7:35 - 8:55	9:47 - 10:33

3.1.1 Species Lists and Indices of Bird Relative Abundance

A total of 852 individual birds, representing 44 species, from 16 families were observed during these surveys (Table 2). The most frequently observed species was the white-throated sparrow, with a relative abundance of 12.4 percent. The next most frequently observed species were golden-crowned kinglets (11.0 percent), black-capped chickadees (9.5 percent), and yellow-rumped warblers (9.2 percent).

Birds in the sparrow family (*Emberizidae*) were most frequently observed. A total of six species plus two unidentified groups of sparrows collectively represented 29.9 percent of all birds recorded. One of the unidentified groups of sparrows included three individuals that flew up from the transect and out of sight too quickly to be identified. The other unidentified group of sparrows included approximately 70 individuals observed within two mixed flocks. Mixed flocks are common during migration (Berner & Grubb 1985, Ehrlich 1988). The general composition of these flocks was noted, but numbers of each species within them were not quantified. Both groups of unidentified sparrows were foraging and vocalizing and were observed on the Kibby Range valley transect.

Birds in the warbler family (*Parulidae*) were second most frequently observed with 10 total species and a group of unknown species collectively comprising 20.5 percent of all observations. Of 43 individual warblers that could not be identified (i.e., the one unknown group), most (81 percent) were recorded on valley transects. These individuals were typically observed in flight (84 percent were recorded as flying) and could not be readily identified. Others were recorded as

vocalizing; these may have been difficult to see, or out of sight and performing non-differentiating calls.

Two species of kinglets represent the third most abundant family, Regulidae (13.0 percent). These species are migrants, though golden-crowned kinglets are commonly found in the project area year-round. Note that the three most abundant families observed are largely comprised of migratory species.

Two species of chickadees represent the fourth most abundant family, Paridae (11.3 percent). These species are primarily resident in the project area.

The mixed flock, listed on Table 2 as "Other," was composed mostly of black-throated blue warblers, with smaller numbers of other warbler species as well as black-capped chickadees, boreal chickadees, dark-eyed juncos, a warbling vireo, and others.

Table 2: Species List and Relative Abundance

Family	Species (common name)	Species (Latin name)	Status [2]	#	Relative Abundance
Accipitrinae	Raptor sp.	*n/a*	*n/a*	1	0.1%
	Red-tailed hawk	*Buteo jamaicensis*	B/W	1	0.1%
Subtotal:				***2***	***0.2%***
Anatadinae	Canada goose	*Branta canadensis*	B	52	6.1%
Subtotal:				***52***	***6.1%***
Bombycillidae	Cedar waxwing	*Bombycilla cedrorum*	B	3	0.4%
Subtotal:				***3***	***0.4%***
Corvidae	Raven	*Corvus corax*	PR	2	0.2%
	Gray jay	*Perisoreus canadensis*	PR	7	0.8%
	Blue jay	*Cyanocitta cristata*	PR	21	2.5%
Subtotal:				***30***	***3.5%***
Emberizidae	Vesper sparrow [1]	*Pooecetes gramineus*	B	1	0.1%
	Savannah sparrow	*Passerculus sandwichensis*	B	1	0.1%
	Song sparrow	*Melospiza melodia*	B	1	0.1%
	Lincoln's sparrow	*Melospiza lincolnii*	B	5	0.6%
	White-throated sparrow	*Zonotrichia albicollis*	B	106	12.4%
	Dark-eyed junco	*Junco hyemalis*	B/W	68	8.0%
	Mixed flock (sparrows)	*n/a*	B	70	8.2%
	Sparrow sp.	*n/a*	B	3	0.4%
Subtotal:				***255***	***29.9%***
Fringillidae	Purple finch	*Carpodacus purpureus*	PR	2	0.2%
	American goldfinch	*Carduelis tristis*	PR	6	0.7%
Subtotal:				***8***	***0.9%***
Icteridae	Rusty blackbird [1]	*Euphagus carolinus*	B	2	0.2%
Subtotal:				***2***	***0.2%***
Paridae	Boreal chickadee	*Poecile hudsonica*	PR	15	1.8%
	Black-capped chickadee	*Poecile atricapillus*	PR	81	9.5%
Subtotal:				***96***	***11.3%***

(Continued on following page)

Parulidae	Bay-breasted warbler	*Dendroica Castanea*	B	1	0.1%
	Ovenbird	*Seiurus aurocapilla*	B	2	0.2%
	American redstart	*Setophaga ruticilla*	B	2	0.2%
	Chestnut-sided warbler	*Dendroica pensylvanica*	B	1	0.1%
	Nashville warbler	*Vermivora ruficapilla*	B	6	0.7%
	Magnolia warbler	*Dendroica magnolia*	B	6	0.7%
	Black-throated blue warbler	*Dendroica caerulescens*	B	11	1.3%
	Blackpoll warbler	*Dendroica striata*	B	15	1.8%
	Common yellowthroat	*Geothlypis trichas*	B	10	1.2%
	Yellow-rumped warbler	*Dendroica coronata*	B	78	9.2%
	Warbler sp.	*n/a*	B	43	5.0%
Subtotal:				***175***	***20.5%***
Phasianidae	Ruffed grouse	*Bonasa umbellus*	PR	6	0.7%
Subtotal:				***6***	***0.7%***
Picidae	Black-backed woodpecker	*Picoides arcticus*	PR	1	0.1%
	Downy woodpecker	*Picoides pubescens*	PR	1	0.1%
	Northern flicker	*Colaptes auratus*	B	5	0.6%
	Hairy woodpecker	*Picoides villosus*	PR	7	0.8%
	Woodpecker sp.	*Picoides sp.*	*n/a*	1	0.1%
Subtotal:				***15***	***1.8%***
Regulidae	Ruby-crowned kinglet	*Regulus calendula*	B	17	2.0%
	Golden-crowned kinglet	*Regulus satrapa*	B/W	94	11.0%
Subtotal:				***111***	***13.0%***
Sittidae	White-breasted nuthatch	*Sitta carolinensis*	PR	1	0.1%
	Red-breasted nuthatch	*Sitta canadensis*	PR	5	0.6%
Subtotal:				***6***	***0.7%***
Troglodytidae	Winter wren	*Troglodytes troglodytes*	B	16	1.9%
Subtotal:				***16***	***1.9%***
Turdidae	Gray-cheeked/Bicknell's	*Catharus sp.*	B	1	0.1%
	Bicknell's thrush [1]	*Catharus bicknelli*	B	3	0.4%
	Hermit thrush	*Catharus guttatus*	B	1	0.1%
	American robin	*Turdus migratorius*	B	11	1.3%
	Thrush sp.	*Catharus sp.*	B	4	0.5%
Subtotal:				***20***	***2.3%***
Vireonidae	Red-eyed vireo	*Vireo olivaceus*	B	1	0.1%
	Blue-headed vireo	*Vireo solitarius*	B	4	0.5%
Subtotal:				***5***	***0.6%***
Other	Mixed flock	*n/a*	*n/a*	50	5.9%
Subtotal:				***50***	***5.9%***
TOTALS				**852**	**100%**

[1] Species of Special Concern, MDIFW 2005

[2] B=Potential Breeder in Project Area; PR=Permanent Resident; W=Wintering in Project Area; M = Migrant

The most abundant families observed in the fall of 1994 are consistent with observations recorded in 2005, with sparrows, warblers, kinglets and chickadees (in order of descending abundance) topping the list. White-throated sparrow (a migratory species) followed by golden-crowned kinglets (a migratory species found in the project area year-round) were the most commonly observed species in 1994: these results are also consistent with observations made in 2005. The third and fourth most abundant species recorded in 1994 (dark-eyed juncos and black-capped chickadees) were also among the most abundant species observed in 2005.

No threatened or endangered species were identified during fall 2005 surveys. However, three of the species identified are listed as species of Special Concern in the State of Maine. These include Bicknell's thrush, vesper sparrow, and rusty blackbird. The Bicknell's thrush is also federal-listed as a species of Special Concern.

In Maine, species of Special Concern are defined as "any species of fish or wildlife that does not meet the criteria as Endangered or Threatened but is particularly vulnerable and could easily become a Threatened Species or an Endangered or Extirpated Species due to restricted distribution, low or declining numbers, specialized habitat needs or limits, or other factors, or is a species suspected to be Endangered or Threatened or likely to become so but for which insufficient data are available" (MDIFW 2005). Special Concern is an administrative category, which has no legal standing under the state's Endangered Species statutes. A federal-listed species of Special Concern applies to species which may or may not be listed in the future, or species under consideration for listing for which there is insufficient information to support listing.

All three of these species of Special Concern are potential breeders in Kibby and Skinner Townships, and are migrants. None are year-round residents.

3.1.2 Observed Behavior and Substrate Use

3.1.2.1 Frequency of Behaviors Observed

Vocalization (call note utterance) was the most frequently observed behavior, with 599 (70.3 percent) of the 852 birds observed performing vocalizations. Foraging was the second most common behavior recorded at 46.9 percent, followed by flying at 25.1 percent (see Table 3). One bird was observed only to perch, and the three birds recorded in the "other" column of Table 3 were chasing one another. Foraging behavior is to be expected because the three most abundant families observed were migratory species which typically forage during stopovers to replenish energy burned in flight. Vocalization is often associated with flocking and foraging, which are common behaviors during migratory stopovers.

Note that birds that were observed to perform multiple activities were recorded as such. For example, the mixed flock of 50 individuals was likely foraging, as mixed flocks are often aggregated for the purpose of increased foraging efficiency (Berner & Grubb 1985, Dolby & Grubb 1998, Ehrlich 1988, Valburg 1992). Therefore, they are recorded below as "foraging." However, vocalization was also a primary behavior of the flock at the time of observation; for this reason, this flock of 50 is also enumerated among the vocalizing birds.

Table 3: Frequency of Behaviors Observed

Family	#	Behavior				
		Fly	Forage	Vocalize	Perch	Other
Accipitrinae	*2*	1	0	1	0	0
Anatadinae	*52*	52	0	0	0	0
Bombycillidae	*3*	0	3	3	0	0
Corvidae	*30*	27	1	13	0	0
Emberizidae	*255*	23	183	195	0	0
Fringillidae	*8*	3	4	4	0	0
Icteridae	*2*	0	1	1	0	0
Paridae	*96*	0	32	90	0	0
Parulidae	*175*	84	58	95	1	3
Phasianidae	*6*	5	0	1	0	0
Picidae	*15*	4	3	9	0	0
Regulidae	*111*	4	49	100	0	0
Sittidae	*6*	1	1	5	0	0
Troglodytidae	*16*	0	11	15	0	0
Turdidae	*20*	10	3	12	0	0
Vireonidae	*5*	0	1	5	0	0
Other (mixed flock)	*50*	0	50	50	0	0
TOTAL #	**852**	***214***	***400***	***599***	***1***	***3***
Percent of Total		**25.1%**	**46.9%**	**70.3%**	**0.1%**	**0.4%**

3.1.2.2 Avian Use by Substrate

Trees were the most frequently used substrate, with 49.3 percent of all birds observed using trees (see Table 4). Shrubs were the next most utilized substrate, with 24.2 percent of all birds observed using shrubs. Most birds (44.8 percent of all observed) used shrubs or trees in stands of mixed growth, while 12.9 percent and 13.8 percent were associated with deciduous or coniferous growth, respectively. It should be noted that many of the species observed forage by gleaning foliage or tree bark (Ehrlich et al. 1988). The ground was the least common substrate recorded, with 15.3 percent of all birds observed using the ground. Members of the family Emberizidae (sparrows: typically ground-gleaners) were most frequently observed on the ground or in shrubs, while most other families tended to be associated with trees.

Table 4: Number of Observations by Substrate

Family	#	Substrate						
		Ground	Shrub	Tree	Deciduous	Conifer	Mixed	Unk.
Accipitrinae	***2***	0	0	1	0	0	1	0
Anatadinae	***52***	0	0	0	0	0	0	0
Bombycillidae	***3***	0	3	0	3	0	0	0
Corvidae	***30***	0	4	9	7	4	2	0
Emberizidae	***255***	113	113	63	20	30	122	0
Fringillidae	***8***	0	4	1	4	0	1	0
Icteridae	***2***	1	0	1	1	0	0	0
Paridae	***96***	0	18	76	12	14	69	2
Parulidae	***175***	3	35	84	39	37	35	0
Phasianidae	***16***	6	4	5	3	2	4	1
Picidae	***15***	1	4	6	2	0	8	3
Regulidae	***111***	0	15	98	16	23	71	0
Sittidae	***6***	0	1	6	1	3	2	0
Tetraoninae	***6***	5	1	0	0	0	0	0
Turdidae	***20***	1	4	15	1	5	13	0
Vireonidae	***5***	0	0	5	1	0	4	0
Other (mixed flock)	***50***	0	0	50	0	0	50	0
TOTAL #	**852**	***130***	***206***	***420***	***110***	***118***	***382***	***6***
Percent of Total		**15.3%**	**24.2%**	**49.3%**	**12.9%**	**13.8%**	**44.8%**	**0.7%**

3.1.3 Distribution by Habitat Type (Site)

3.1.3.1 Habitat Descriptions by Site

Kibby Range Valley

The habitat in the vicinity of the Kibby Range valley transect is best described as Spruce-Northern Hardwoods Forest (Gawler and Cutko 2004). Common tree, sapling, and shrub species included balsam fir (*Abies balsamea*), paper birch (*Betula papyrifera*), yellow birch (*Betula alleghaniensis*), red spruce (*Picea rubens*), red maple (*Acer rubrum*), and sugar maple (*Acer saccharum*). Hobblebush (*Viburnum alnifolium*), striped maple (*Acer pensylvanicum*), American mountain ash (*Sorbus americana*), and several willow species (*Salix* spp.) were also common in the shrub layer. Common herbaceous plants included mountain woodfern (*Dryopteris campyloptera*), intermediate woodfern (*Dryopteris intermedia*), northern wood sorrel (*Oxalis montana*), Canada dogwood (*Cornus canadensis*), and bluebead lily (*Clintonia borealis*), long beech fern (*Thelypteris phegopteris*), starflower (*Trientalis borealis*), red raspberry (*Rubus idaeus*), and wild sarsaparilla (*Aralia nudicalis*). There were several areas of mixed-age forest along this transect due to past forest harvesting activities; this added both structural and compositional variability to the habitat.

Kibby Range Ridge

The habitat in the vicinity of the Kibby Range ridge transect ascends through Spruce-Northern Hardwoods Forest which transitions into a mixed Spruce-Fir-Wood Sorrel-Feathermoss and Fir-Heartleaved Birch forest at higher elevations (Gawler and Cutko 2004). Dominant vegetation along the transect included trees, saplings, and shrubs of balsam fir, red spruce, yellow birch, and paper birch, and mountain ash saplings and shrubs. Common herbaceous plants included hay-scented fern (*Dennstaedtia punctilobula*), red raspberry, mountain and intermediate woodfern, northern wood sorrel, Canada dogwood, and bluebead lily.

Kibby Mountain Valley

The habitat in the vicinity of the Kibby Mountain valley transect is a Spruce-Northern Hardwoods community (Gawler and Cutko 2004). Dominant vegetation along the transect included balsam fir, red spruce, yellow birch, paper birch, and red maple. Hobblebush, striped maple, and American mountain ash were common in the shrub layer. Common herbaceous plants included mountain and intermediate wood fern, Canada dogwood, large-leaved golden rod (*Solidago macrophylla*), and wild sarsaparilla.

Kibby Mountain Ridge

The habitat in the vicinity of the Kibby Mountain ridge transect is a Spruce-Fir-Wood Sorrel-Feathermoss Forest at the lower elevations transitioning into a Fir-Heartleaved Birch Subalpine Forest at the higher elevations (Gawler and Cutko 2004). The most common plant species in the tree, sapling, and shrub strata were red spruce and balsam fir. However, heart-leaved paper birch and mountain ash species were also a common component of the tree and sapling strata. The dominant shrubs were American mountain ash, northern mountain ash, and red elderberry (*Sambucus pubens*), and common species in the herbaceous layer included northern wood sorrel, Canada dogwood, bluebead lily, mountain woodfern, and intermediate woodfern.

3.1.3.2 Avian Use by Site

The distribution of species varies with site (Table 5). Parids (chickadees) were observed more frequently in valleys than on ridges, with comparatively more frequent observations in Kibby Mountain valley. Regulids (kinglets) were observed more frequently in Kibby Mountain valley than at other transects. Corvids (crows and jays), Emberizids (sparrows), Parulids (warblers) and Picids (woodpeckers) were all observed more frequently on the Kibby Range valley transect than in any other location. Among all transects, Kibby Range valley had the largest number of avian families (14 total families), while Kibby Mountain Ridge had the lowest (eight families). Kibby Range Ridge and Kibby Mountain Valley supported 10 and 11 families, respectively.

Table 5: Avian Family Use by Site

Family	#	Site							
		Kibby Mountain Valley		Kibby Mountain Ridge		Kibby Range Valley		Kibby Range Ridge	
		Indiv	Fam	Indiv	Fam	Indiv	Fam	Indiv	Fam
Accipitrinae	***2***	0		0		2	1	0	
Anatadinae	***52***	40	1	0		12	1	0	
Bombycillidae	***3***	0		0		3	1	0	
Corvidae	***30***	4	1	1	1	21	1	4	1
Emberizidae	***255***	25	1	29	1	179	1	21	1
Fringillidae	***8***	0		1	1	7	1	0	
Icteridae	***2***	0		0		2	1	0	
Paridae	***96***	44	1	12	1	29	1	11	1
Parulidae	***175***	29	1	21	1	91	1	35	1
Phasianidae	***16***	4	1	0		0		12	1
Picidae	***15***	0		0		13	1	2	1
Regulidae	***111***	29	1	38	1	26	1	18	1
Sittidae	***6***	1	1	2	1	2	1	1	1
Tetraoninae	***6***	5	1	0		0		1	1
Turdidae	***20***	8	1	8	1	4	1	0	
Vireonidae	***5***	2	1	0		2	1	1	1
Other (mixed flock)	***50***	50	n/a	0		0		0	
TOTAL INDIVIDUALS	***852***	***241***		***112***		***393***		***106***	
TOTAL FAMILIES			***11***		***8***		***14***		***10***

The two valley transects yielded higher average observations per unit effort than the ridge transects. The Kibby Range valley transect had the highest number of observations per unit effort from among all locations. The ridge transects were comparable to one another in average numbers of observations per unit effort (see Table 6). This suggests that the lower elevation areas within the project vicinity contain habitats that may more favorable to daytime foraging birds than the higher elevation areas.

Table 6: Average Observations per Unit Effort, by Site

Site	Length (km)	Number of Visits	Total Birds Observed	Units Effort (Length x No. Visits)	Average Observations per km (Unit Effort)
Kibby Mountain Valley	1.5	5	241	7.5	32.13
Kibby Mountain Ridge	1.25	5	112	6.25	17.92
Kibby Range Valley	1.9	5	394	9.5	41.47
Kibby Range Ridge	1.18	5	106	5.9	17.97

3.1.4 Patterns in the Nature of the Avian Community

3.1.4.1 Shannon-Weiner Diversity

The Shannon-Weiner diversity index (H) was used to assess overall patterns in avian community by site (transect). The highest diversity index was observed within Kibby Range Valley, followed by Kibby Mountain Valley, then Kibby Range Ridge. The lowest diversity index was observed on Kibby Mountain Ridge (Table 7). Community evenness (J) is moderately elevated across all sites, although evenness observed at Kibby Mountain Ridge is slightly lower than all other sites. The greatest species richness (R) and numbers of organisms (N) were observed at the Kibby Range Valley site.

Table 7: Community Metrics Across Sites

Site	Diversity (H)	Evenness (J)	Species Richness (R)	Numbers of Organisms (N)
Kibby Range Valley	2.78	0.75	41	377
Kibby Range Ridge	2.30	0.80	18	121
Kibby Mountain Valley	2.41	0.76	24	242
Kibby Mountain Ridge	2.15	0.74	18	112
Pooled Ridge	2.50	0.78	25	233
Pooled Valley	2.96	0.76	48	619

Based on this analysis, it appears that the avian communities in valleys are more diverse and species rich than their ridge counterparts. A Mann-Whitney test, which compared valleys and ridges in general then each site individually to all others, showed that this difference is statistically significant (Table 8). Significant differences in diversity (H) were also observed between the two ridge sites and the Kibby Range Valley site. The Kibby Mountain Valley site, however, was not significantly dissimilar to any other specific site.

Table 8: Mann-Whitney U-test *p*-value Matrix

Site	Ridge Sites	Valley Sites	Kibby Range Valley	Kibby Range Ridge	Kibby Mountain Valley
Ridge Sites	--				
Valley Sites	**0.006**	--			
Kibby Range Valley	NA	NA	--		
Kibby Range Ridge	NA	NA	**0.001**	--	
Kibby Mountain Valley	NA	NA	0.060	0.118	--
Kibby Mountain Ridge	NA	NA	**0.002**	0.667	0.144

Note: Boldfaced values are statistically significant where $p \leq 0.05$.

3.1.4.2 Morisita Index of Similarity

The Morisita Index of Similarity was used to investigate the degree to which diversity changes between sites by exploring the degree of species turnover. The lowest degree of similarity was observed between the Kibby Mountain Ridge site and the Kibby Range Valley site, while the remaining sites exhibit moderate to somewhat high degrees of avian community similarity (Table 9). The low similarity index between the Kibby Range Valley and the Kibby Mountain Ridge

sites indicates that species composition is markedly different at the two sites and may be suggestive of habitat differences.

Table 9: Morisita Similarity Index Matrix

Site	Kibby Range Valley	Kibby Range Ridge	Kibby Mountain Valley	Kibby Mountain Ridge
Kibby Range Valley	--			
Kibby Range Ridge	0.683	--		
Kibby Mountain Valley	0.669	0.417	--	
Kibby Mountain Ridge	0.279	0.511	0.545	--

An examination of the distribution of all species observed across all sites is revealing and at least partially explains the observed differences in the Shannon-Weiner and Morisita indices (Table 10). The most noticeable differences include the pulses of mixed sparrow "flocks" at the Kibby Range Valley and Kibby Mountain Valley sites, and the complete absence of these flocks at the other two sites. Other marked differences in distribution across sites are exhibited by the white-throated sparrow, which is dominant at the Kibby Range Valley site, and is represented by only a single individual at the Kibby Mountain Ridge site.

Table 10: Morisita Raw Data Summary (Including Absence Data)

Species	Kibby Range Valley	Kibby Range Ridge	Kibby Mountain Valley	Kibby Mountain Ridge
American gold finch	5	0	0	1
American robin	2	0	6	3
Bay-breasted warbler	1	0	0	0
Bicknell's Thrush	0	0	0	3
Black-throated blue Warbler	3	3	4	1
Black-backed woodpecker	0	1	0	0
Black-capped chickadee	25	8	37	11
Blackpoll warbler	3	4	0	8
Blue-headed vireo	0	1	1	0
Blue jay	20	0	1	0
Boreal chickadee	4	3	7	1
Broad-winged hawk	0	0	0	0
Canada goose	12	0	40	0
Cedar waxwing	3	0	0	0
Chestnut-sided warbler	1	0	0	0
Common yellowthroat	10	0	0	0
Connecticut warbler	0	0	0	0
Dark-eyed junco	10	8	22	28
Dendroica sp.	0	0	0	0
Downy woodpecker	1	0	0	0

(Continued on following page)

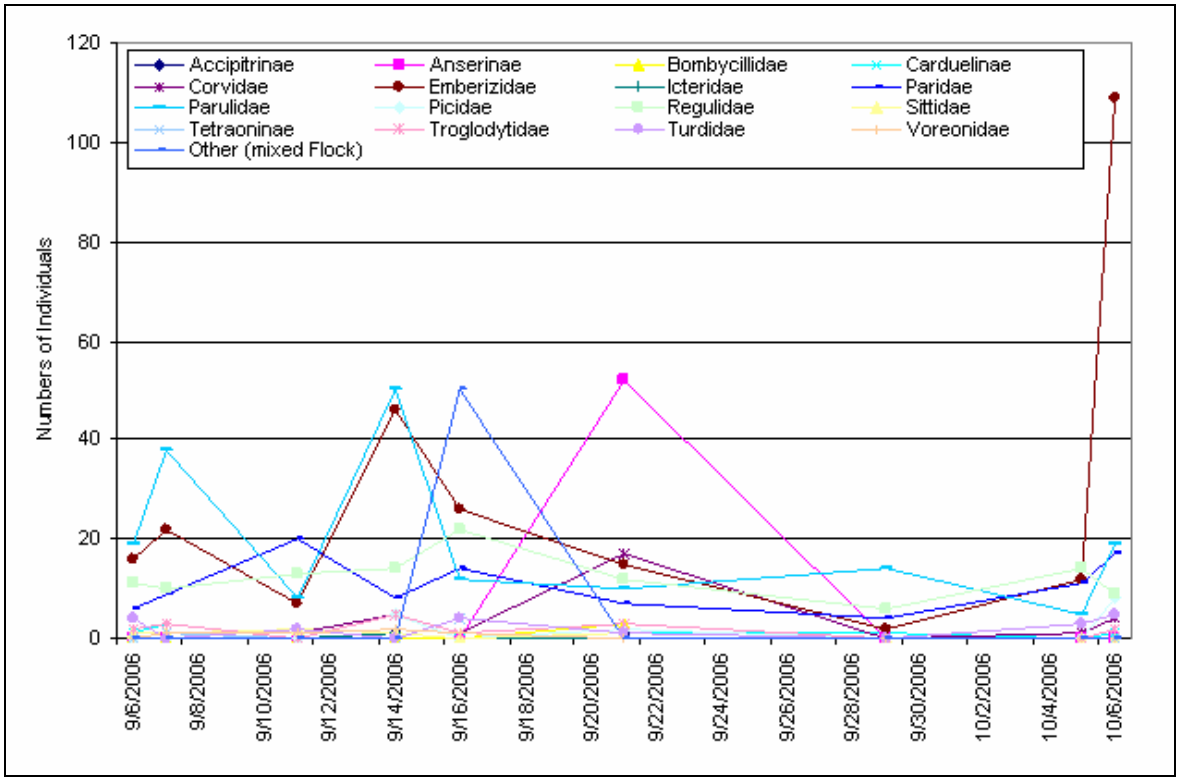
Species	Kibby Range Valley	Kibby Range Ridge	Kibby Mountain Valley	Kibby Mountain Ridge
Flicker	5	0	0	0
Golden-crowned kinglet	15	17	29	33
Gray Cheeked/Bicknell's	0	0	0	1
Gray Jay	0	4	2	1
Hairy woodpecker	6	1	0	0
Hermit Thrush	0	0	1	0
Lincoln's sparrow	5	0	0	0
Magnolia Warbler	3	2	1	0
Mixed flock (sparrows)	70	0	50	0
Nashville warbler	3	2	1	0
Ovenbird	0	0	2	0
Purple finch	2	0	0	0
Raptor sp.	1	0	0	0
Raven	1	0	1	0
Red-breasted nuthatch	1	1	1	2
Red-eyed vireo	1	0	0	0
Redstart	1	0	0	1
Red-tailed hawk	1	0	0	0
Ruby-crowned kinglet	11	1	0	5
Ruffed Grouse	0	1	5	0
Rusty black bird	2	0	0	0
Savannah sparrow	1	0	0	0
Solitary vireo	1	0	1	0
Song sparrow	1	0	0	0
Sparrow sp.	3	0	0	0
Thrush sp.	2	0	1	1
Vesper sparrow	1	0	0	0
Warbler sp.	28	0	7	8
White-throated sparrow	73	28	4	1
White-breasted nuthatch	1	0	0	0
Winter wren	0	12	4	0
woodpecker sp.	1	0	0	0
Yellow-rumped warbler	37	24	14	3
SUM	**377**	**121**	**242**	**112**
TOTAL NUMBERS OF ORGANISMS	**852**			

3.1.5 Temporal Use by Migrant Species

Many migratory species were observed during fall 2005 foraging bird surveys, however they were generally dominated by members of four families. These include the Emberizids (sparrows), Turdids (thrushes), Regulids (kinglets), and Parulids (warblers).

The presence of thrushes, although relatively infrequent in comparison to other migrant groups, was fairly consistent throughout the fall 2005 study (Figure 4). Warblers (*Parulidae*) were present and relatively abundant throughout the fall 2005 season, with numbers peaking in mid-September. Numbers of warblers tapered somewhat in late September and were generally stable for the remainder of the season. Sparrows (*Emberizidae*) were relatively abundant throughout the fall 2005 season with a moderate peak in mid-September and a comparatively larger peak in early-October. Kinglets (*Regulidae*) were consistently abundant throughout the fall.

Figure 4: Families Observed by Date



3.2 Species Recorded During Incidental Observations

Incidental observations were recorded between survey events by surveying biologists while in the Kibby vicinity. The purpose of these observations is to document noteworthy species that may not have been observed during surveys. Many of the species observed incidentally are migratory species, and are therefore representative of migrant species moving through the project area.

Several species were recorded during incidental observations throughout the study area. For the most part, the incidental species noted were also recorded in a quantifiable manner during foraging bird surveys. Those species that were observed incidentally, but were not observed during foraging bird surveys, are listed on Table 11.

Table 11: Incidental Species Not Observed During Foraging Bird Surveys

Common Name	Latin Name	Date
Connecticut warbler	*Oporornis agilis*	1-Sep
Peregrine falcon	*Falco peregrinus*	14-Sep
Northern parula	*Parula americana*	14-Sep
Blackburnian warbler	*Dendroica fusca*	14-Sep
Black-throated green warbler	*Dendroica virens*	14-Sep
Horned lark	*Eremophila alpestris*	27-Sep
Spruce grouse	*Falcipennis canadensis*	28-Sep
American pipit	*Anthus rubescens*	4-Oct

Breeding populations of the peregrine falcon and the American pipit are each listed as an Endangered species in the State of Maine. Although rare, peregrine falcons could potentially breed in Skinner and/or Kibby Townships. However, there are no known records of this species breeding in or near the project location. American pipits breed in alpine or arctic habitats: the only known breeding population in the State of Maine is located on Mount Katahdin. As such, this species is unlikely to breed in or near the project location.

4.0 SUMMARY OF FINDINGS

A total 852 individual birds, representing 44 species from 16 families, were observed during these surveys. Birds in the sparrow family (*Emberizidae*) were most frequently observed, representing 29.9 percent of all birds recorded. Birds in the warbler family (*Parulidae*) were second most frequently observed, comprising 20.5 percent of all observations. Two species of kinglets represent the third most abundant family, Regulidae (13.0 percent), and two species of chickadees represent the fourth most abundant family, Paridae (11.3 percent). The three most abundant families observed are largely comprised of migratory species, while the fourth most abundant family observed is comprised primarily of resident species.

Vocalization (call note utterance) was the most frequently observed behavior, with 599 (70.3 percent) of the 852 birds observed performing vocalizations. Foraging was the second most common behavior recorded at 46.9 percent, followed by flying at 25.1 percent.

Trees and shrubs were the most frequently used substrates, with 49.3 percent and 24.2 percent of all birds observed using these substrates, respectively. Most birds (44.8 percent of all observed) used shrubs or trees in stands of mixed growth, while 12.9 percent and 13.8 percent were associated with deciduous or coniferous growth, respectively. The ground was the least common substrate recorded, with 15.3 percent of all birds observed using the ground.

The distribution of species varies with site. Among all transects, Kibby Range valley had the largest number of avian families (14 total families), while Kibby Mountain Ridge had the lowest (eight families). Kibby Range Ridge and Kibby Mountain Valley supported 10 and 11 families, respectively.

The Shannon-Weiner diversity index found that the highest species diversity was observed within Kibby Range Valley, followed by Kibby Mountain Valley, then Kibby Range Ridge. The lowest diversity index was observed on Kibby Mountain Ridge.

Based on this analysis, it appears that the avian communities in valleys are more diverse and species rich than their ridge counterparts. A Mann-Whitney test, which compared valleys and ridges in general then each site individually to all others, showed that difference is statistically significant.

The Morisita Index of Similarity showed the lowest degree of similarity between the Kibby Mountain Ridge site and the Kibby Range Valley site, while the remaining sites exhibit moderate to somewhat high degrees of avian community similarity. The low similarity index between the Kibby Range Valley and the Kibby Mountain Ridge sites indicates that species composition is markedly different at the two sites and may be suggestive of habitat differences.

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APPENDIX A

Daytime Avian Migration Survey Protocol For the Kibby Wind Power Project

Daytime Avian Migration Survey Protocol for the Kibby Wind Power Project

Prepared for:
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August 2005

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1.0 PROJECT DESCRIPTION

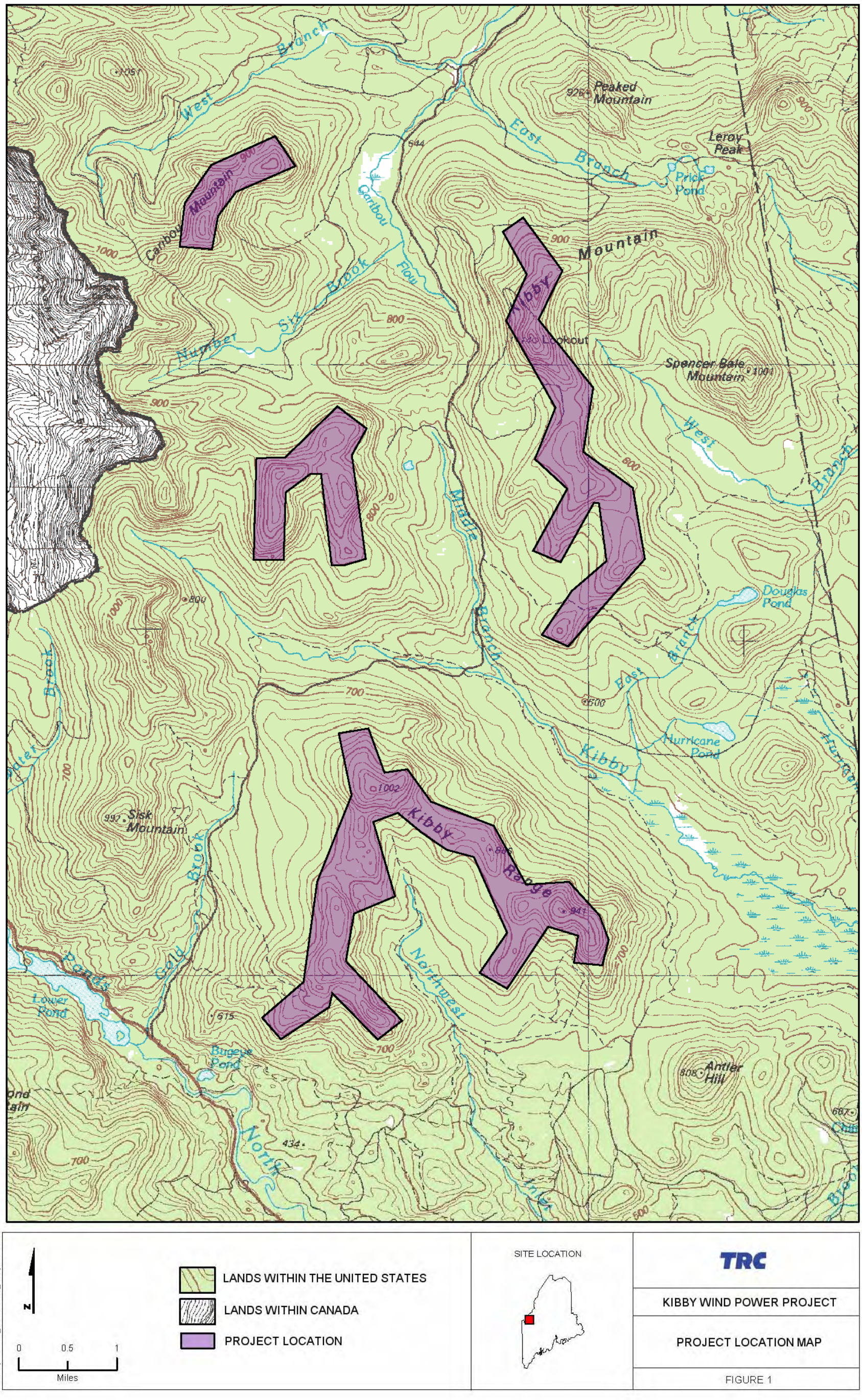
TransCanada Energy Ltd. (TransCanada) is proposing to develop, own and operate a 100–200 megawatt (MW) wind power generating facility in the Boundary Mountains of Western Maine known as the Kibby Wind Power Project. The project is in a location for which a similar project proposal by U.S. Windpower was previously approved by the Land Use Regulation Commission (LURC). TransCanada intends to conduct additional baseline studies and utilize existing information from the previous licensing effort to determine appropriately the level of potential impact associated with the project.

The project will be located in an unincorporated area of Franklin County, Maine. Turbine locations are anticipated to be established along four ridgelines within the project area, as shown in Figure 1. The property is owned by Plum Creek (formerly owned by SD Warren), and the surrounding areas are currently actively managed for forest products. The Kibby Wind Power Project can take advantage of existing logging roads and cleared areas to access the ridgelines, and forestry activities can continue in a complementary fashion with the project in place. The project will utilize the superior wind resource found in this vicinity to create clean, renewable power generation.

As currently proposed, the Kibby Wind Power Project will be developed in two phases. The first 100-MW phase will involve the installation of approximately 67 GE 1.5 MW turbines (which have a hub height of 65 meters and a rotor diameter of 70.5 meters). The turbines will require access, as well as a gathering system for consolidating their electrical output at a common substation. From that proposed substation, a 115 kilovolt (kV) transmission line will be installed. Depending upon system requirements, the electrical interconnection will be installed to the existing substation at either Stratton or Bigelow, a distance of approximately 20 to 28 miles. It is anticipated that the electrical interconnection work will occur in part within the town of Eustis, likely requiring a local and Maine Department of Environmental Protection (MDEP) permitting process in addition to LURC approval.

A second project phase is being considered, which would involve installation of an additional 100-MW array of GE 1.5 MW turbines. Due to electricity transmission capacity constraints, this second phase would include a 115 kV interconnection to the Hydro Quebec bulk transmission system in the Lac Megantic region of Quebec (approximately 25 miles away). From that point, electricity would be available for sale into both Canada and the United States (U.S.). This portion of the project would require, in addition to the full array of environmental permits, review under a Presidential Permit by the U.S. Department of Energy.

Figure 1: Project Location Map



It is estimated that, for both project phases, approximately 30 miles of new roads could be required for access to turbine locations. TransCanada will endeavor to minimize impacts to wetlands and erosive soils and to utilize existing roadways to the extent possible. Although clearing will be required for construction and operation of the wind turbines, and to allow for electrical infrastructure, clearing will be minimized to the extent possible. The location of the project is relatively remote from public view. Visual change in the landscape will be assessed and presented, however, views of the project are anticipated to be distant and from limited locations. Construction jobs will result from the project, as well as approximately 15 to 20 permanent jobs for the region.

TransCanada Energy Ltd. is a subsidiary of TransCanada Corporation, an established Canadian company, with a proven track record in developing large infrastructure projects, including numerous wind projects currently ongoing in Canada. An important hallmark of its development process is to establish and maintain strong, open and responsible relationships with the communities within which they will operate facilities and with the regulatory agencies tasked with project oversight. In order to provide adequate information as a basis for agency decision-making, TransCanada intends to supplement existing available information from the U.S. Windpower project with comprehensive environmental studies. This draft protocol is intended to outline a scope of work to address one element of those environmental evaluations so an opportunity is afforded for agency input prior to implementation.

A LURC application is currently being prepared that will request installation of up to eight meteorological towers (met towers) for the purposes of collecting site-specific wind data in support of more detailed design and layout information. The met towers are also intended for use during environmental studies (for example, bat surveys, where installation of monitoring devices at an elevated location provides the best possible data). Environmental studies are anticipated to commence in late July 2005, with the met tower LURC application anticipated to be submitted in August. Given TransCanada's desire to include environmental data from both the fall and spring seasons, the LURC rezoning petition and preliminary development plan (and necessary MDEP application material) is anticipated to be filed in the summer of 2006. TransCanada hopes to obtain permits by spring 2007 so construction can commence at that time, taking advantage of the summer and fall construction season. Commercial operation is anticipated by approximately December 2008. Timely review and comment on study protocols will be encouraged to ensure that all applicable input is applied in even the earliest stages of project work.

2.0 PROTOCOL INTRODUCTION

As part of pre-construction analyses for the Kibby Wind Power Project, several studies will be performed that will assist in determining which avian species use the project area, and how they use it. The specific purpose of daytime avian migration surveys is to observe the approximate numbers, species, and patterns of use by spring and fall daytime migrants in the project vicinity, and develop a qualitative assessment of general patterns of use by migrating birds in the vicinity of the proposed Kibby Wind Power Project. Two different surveys will be done for daytime migrants: an early morning foraging migrant survey and a daytime migrant survey. Data collected at these sites will also be compared with data collected in prior studies of the project area. In addition, available data collected by others in the study vicinity will be utilized to supplement the project surveys.

2.1 Objectives

The main objectives of daytime avian migration surveys are to:

- Obtain a quantitative assessment of species composition, relative abundance, distribution, and spatial patterns of use by birds migrating during daytime hours in and around the project area;
- Identify migrant species foraging in the project area;
- Identify route(s) used by daytime migrating birds passing through/near project area; and
- Evaluate potential for collisions at proposed turbine sites.

2.2 Prior Studies

From 1992 to 1994, U.S. Windpower monitored fall raptor migration in the vicinity of the project. Their work consisted of day-long surveillance during peak migration and identified numbers and species of raptors crossing the project area. The goals were to identify raptor species' relative abundance, composition, and flight characteristics (flight height, direction, and consistency of use) in the project area. U.S. Windpower also performed studies to characterize morning migration and foraging behavior of migrating songbirds. These studies demonstrated a pattern of use of the area as a minor migratory route for raptors with minimal use as a foraging stopover.

3.0 STUDY METHODOLOGY

3.1 Survey Site Selection

Various locations will be surveyed by transect for the foraging migrant bird survey. Their locations will be scattered throughout the project area. These transects will be sited to represent different habitats of the area (valley, clearcut, mature forest, slopes, ridge top, etc.). The Kibby Mountain fire tower has been selected as the observation point for the daytime migration survey due to its northern location in relation to the project area and its 360-degree visibility.

3.2 Survey Protocol

Foraging migrant bird surveys will be similar to those performed during the fall of 1994 for U.S. Windpower for this site. The survey will be performed by one observer walking slowly along a transect early in the morning. All birds observed will be identified to species, and distance from the transect will be recorded. The behavior of each bird when first observed and foraging birds' locations (including where they are foraging, i.e., substrate: ground, shrubs, trees, etc.) will also be noted.

The methods for the daytime migrant survey protocol are largely based on methods used during daytime migrant monitoring performed for U.S. Windpower for this site and standards set forth by the Hawk Migration Association of North America (HMANA), and by HawkWatch International (Hoffman and Smith 2003).

3.2.1 Number and Timing of Surveys

Surveys will be performed in fall 2005 and spring 2006. Fall 2005 surveys will occur between September 1 and October 15, and the spring 2006 surveys will occur between March 1 and May 31. Seasonal surveys will consist of multiple survey days at each of the survey plots.

Foraging migrant surveys will be performed early in the morning, between dawn and 9 a.m. each day. Each daytime migrant survey day will be divided into two periods, morning (between dawn and noon) and afternoon (between noon and sunset). Observations will be scheduled so as to cover these daylight hours equally.

The purpose of dividing survey events into morning and evening periods is to capture movements of predominantly nocturnal migrants that may be traveling diurnally due to concurrent environmental circumstances (for example, night time rain, low-cloud ceiling, etc.). Such movements are most likely during early morning hours. Raptors and other diurnal migrants are expected to be observed throughout the daytime hours.

Sampling will be performed based upon favorable weather for migration, timed to start the morning after the passage of a cold front. Surveys will be done for three consecutive days following this weather event. Surveys will not be conducted during precipitation, in fog, on days that are overcast with low cloud cover, or during any other circumstances that hamper visibility.

3.2.2 Surveyor Preparedness

For foraging migrant behavior surveys, surveyors will be familiar with the protocol, bird behavior, the transect locations, and will be experienced in bird identification.

For the daytime migrant surveys, surveyors will be familiarized with the topography of the area, including the elevation of the survey site, surrounding ridge elevations and distances from the sampling site, and tree height, prior to starting surveys. Knowledge of these parameters will be useful in estimating flight height. Each surveyor will be trained in the methodology, and will calibrate themselves to the survey site prior to commencing survey activity. Surveyors will also be experienced in bird identification.

3.2.3 Data Collection

Detailed weather and migratory bird observation data will be collected during each survey. All data will be entered onto data sheets. For migrating raptors, data will be collected on forms consistent with those utilized by HMANA, using their suggested codes and guidelines (see Appendix A). Similar but separate data forms will be used to note all other species.

3.2.3.1 Weather Observations

Weather conditions will be noted at the beginning of each survey and hourly thereafter. Data will be collected based on codes and protocol by HMANA, and will be recorded directly onto observation data sheets. Parameters that will be recorded are:

- Wind speed (recorded based on HMANA codes and descriptions)
- Wind direction (compass direction from which the wind is coming, or "variable")
- Temperature (degrees Celsius)
- Humidity (percent relative)
- Barometric pressure
- Percent cloud cover
- Visibility (approximate distance)
- Precipitation

3.2.3.2 Individual Bird Observations

Migratory bird observations will be recorded continuously throughout each survey period. Foraging migrant surveyors will record time of start and end of observations, each for each individual bird observed they will record behavior (flying, foraging, calling, other), and substrate (ground, shrub (deciduous or conifer), tree (deciduous or conifer)).

When collecting data on migrating birds, surveyors will perform continuous scanning with the naked eye and with binoculars. Spotting scopes will be used as necessary to aid in identification.

Observations will be segmented into one-hour periods, but several hours of consecutive data will be collected at each plot. The following data will be recorded for each bird observed:

- Species (if possible)
- Sex (if possible)
- Age class (if possible)
- Altitude at first observation, with noted variations over duration of presence within the survey area (using codes denoting below, within, or above rotor swept area)
- Distance from observation point at first observation, and variations over duration of presence within the survey radius
- Behavior (such as soaring, flapping, circling, gliding, perching, hunting, or other)
- General compass bearing flight direction (S, SSW, NE, etc.)

In the event a bird cannot be identified to the species level, it will be described to the greatest extent possible. For example, unknown raptors will be further described as large or small.

3.2.3.3 Flock Observations

Flock observations will be treated in the same way as individual bird observations, with counts or estimates of the number of birds comprising the flock.

3.2.3.4 Field Quality Assurance and Quality Control

Data sheets will be reviewed for completeness, accuracy, and legibility prior to leaving the survey site. Incidental observation data sheets will be inspected at the end of each survey day. Any problems noted will be rectified at that time; changes to the data sheets will be initialed by the person making the change.

Data will be analyzed concurrently with on-going field work to determine if project objectives are being met or will be met with the types of data and method of data being collected. Since similar protocols have been successfully utilized in other areas, only minor, if any, modifications should be needed during the course of the study, but since every project area is biologically and physically different, data will be frequently evaluated relative to the objectives. Any proposed changes to the protocols will be discussed with Maine Department of Inland Fisheries and Wildlife (MDIFW) prior to implementation.

3.2.4 Data Entry and Analysis

3.2.4.1 Data Entry

Data as recorded onto data sheets in the field will be entered into and stored in a numerical database or spreadsheet format. All entered data will be checked against original field notes and

any errors detected will be corrected using the field data sheets and/or by consulting with the observer.

3.2.4.2 Data Analysis

The following summaries and statistics will be generated to address the objectives and goals of this study.

- Species lists by season and survey location;
- Indices of bird relative abundance;
- Avian migration patterns by species, season, and habitat type;
- Flight paths and heights, by species and season;
- Frequency of behaviors observed;
- Number of observations of foraging by habitat/substrate;
- Relative use among observation points by species and season;
- Number and proportion of observations, by species and season, within the rotor-swept area of the proposed turbines; and
- Number of observations, by species and season, within the proposed development area.

Standard statistical parameters (e.g., means, standard deviations) will be computed, where appropriate. Multivariate techniques such as multiple logistic regression (to estimate the resource selection functions) and multiple regression (to relate relative use in different areas to habitat or topographic features) may also be used, as appropriate, to analyze data.

4.0 REFERENCES

HMANA. 2005. Hawk Migration Association of North America Daily Report Form and data collection instructions. Information available online at: www.hmana.org

Hoffman, S.W., & J.P. Smith. 2003. Population trends of migratory raptors in western North America, 1977-2001. Condor, 105:397-419. Available online at: www.hawkwatch.org/publications/Manuscripts/Hoffman%20and%Smith%20Condor%20105.pdf

APPENDIX A

HMANA DATA FORM AND INSTRUCTIONS

HAWK MIGRATION ASSOCIATION OF NORTH AMERICA

HMANA DAILY REPORT FORM

LOCATION _____ | |

OBSERVER(S) _____ MO___DAY___YR_____

ADDRESS

TIME (STD)	5-6	6-7	7-8	8-9	9-10	10-11	11-12	12-1	1-2	2-3	3-4	4-5	5-6	6-7		
Wind Speed																
Wind Dir. (From)																
Temp. (Deg. C)																
Humidity																
Bar. Pressure																
Cloud Cover																
Visibility																
Precipitation																
Flight Direction																
Height of Flight																
No. of Observers															Total	
Dur. of Obs. (min)																
Black Vulture																BV
Turkey Vulture																TV
Osprey																OS
Swallow-tailed Kite																SK
White-tailed Kite																WK
Mississippi Kite																MK
Hook-billed Kite																HK
Bald Eagle																BE
Northern Harrier																NH
Sharp-shinned																SS
Cooper's Hawk																CH
Northern Goshawk																NG
Red-shouldered																RS
Broad-winged																BW
Short-tailed Hawk																ST
Swainson's Hawk																SW
Red-tailed Hawk																RT
Ferruginous Hawk																FH
White-tailed Hawk																WT
Zone-tailed Hawk																ZT
Harris' Hawk																HH
Rough-legged																RL
Golden Eagle																GE
American Kestrel																AK
Merlin																ML
Peregrine Falcon																PG
Gyrfalcon																GY
Prairie Falcon																PR
Crested Caracara																CC
Unid. Vulture																UV
Unid. Accipiter																UA
Unid. Buteo																UB
Unid. Eagle																UE
Unid. Falcon																UF
Unid. Raptor																UU
Other (From Back)																OO
TOTAL																TH

Comments

Comments: Use back of form. Rarities: List species, hour number and description on back of form.

Rev: 03/98 LEK

GENERAL INSTRUCTIONS:

For weather, enter for the first hour of observation, for following hours only if data changes, if there are no changes, draw a line from the recorded data through the hours in which no change occurred; do not use ditto marks or dashes. For hawks, enter only the number seen (no zeros). Write notes, comments, etc. below. Send completed form to appropriate **Regional Editor** - or to - **HMANA, P.O. Box 822, Boonton,NJ 07005-0822**

Weather and Observation Codes

Wind Speed: Enter code: 0-less than 1 km/h, (calm, smoke rises vertically); 1 - 1-5 km/h, (smoke drift shows wind direction); 2 - 6-11 km/h, (leaves rustle, wind felt on face); 3 - 12-19 km/h, (leaves, small twigs in constant motion; light flag extended); 4 - 20-28 km/h (raises dust, leaves, loose paper; small branches in motion); 5 - 29-38 km/h (small trees in leaf sway); 6 - 39-49 km/h (larger branches in motion; whistling heard in wires); 7 - 50-61 km/h (whole trees in motion; resistance felt walking against the wind); 8 - 62-74 km/h (twigs small branches broken off trees; walking generally impeded); 9 - Greater than 75 km/h.
Wind Direction: Enter compass direction from which the wind is coming, i.e., N, NNE, SE, etc. If variable, enter VAR.
Temperature: Record temperature in degrees Celsius.
Humidity: Record the percent relative humidity.
Barometric Pressure: Record barometric pressure in inches.
Cloud Cover: Record percent of sky with background cloud cover.
Visibility: Judge from your longest view and enter distance in kilometers. To convert miles to kilometers multiply by 1.61.
Precipitation: Enter code: 0 for none, 1 for Haze or Fog, 2 for Drizzle, 3 for Rain, 4 for Thunderstorm, 5 for Snow, 6 for wind driven dust, sand or snow.
Flight Direction: Enter compass direction migrants are heading, i.e., S, SSW, etc.
Height of Flight: Height of Flight. Enter code: 0 - Below rotor sweep; 1 -within rotor sweep; 2 - above rotor sweep; 3 - outside of turbine array area 4 - No predominant height

Observers: Number of observers **CONTRIBUTING** to the count for the hour noted.
Duration of Observation: Specify time in minutes.

COMMENTS

APPENDIX B

Foraging Migrant Data Form and Instructions

Foraging Migrant Survey Data Sheet

Observers:	Date:	Time (start):	Time (end):

Weather (see reverse for instructions)	
wind speed:	bar. press:
wind direction:	cloud cover:
temp (C):	visibility:
humidity:	precipitation:

Location:

ID	Species	#	Behavior (Fl, Fo, Vo, other)	Substrate (Gr, Sh, Tr, de, co)	Distance (meters)	Notes
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
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19						
20						
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22						
23						
24						
25						
26						
27						
28						
29						
30						

GENERAL INSTRUCTIONS:

For weather, enter for the first hour of observation, for following hours only if data changes, if there are no changes, draw a line from the recorded data through the hours in which no change occurred; do not use ditto marks or dashes. For hawks, enter only the number seen (no zeros). Write notes, comments, etc. below. Send completed form to appropriate **Regional Editor** - or to - **HMANA, P.O. Box 822, Boonton,NJ 07005-0822**.

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Humidity: Record the percent relative humidity.
Barometric Pressure: Record barometric pressure in inches.
Cloud Cover: Record percent of sky with background cloud cover.
Visibility: Judge from your longest view and enter distance in kilometers. To convert miles to kilometers multiply by 1.61.
Precipitation: Enter code: 0 for none, 1 for Haze or Fog, 2 for Drizzle, 3 for Rain, 4 for Thunderstorm, 5 for Snow, 6 for wind driven dust, sand or snow.
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Observers: Number of observers **CONTRIBUTING** to the count for the hour noted.
Duration of Observation: Specify time in minutes.

COMMENTS