Spring 2006 Daytime Avian Foraging Survey Report for the Kibby Wind Power Project

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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).

The project will be located in Kibby and Skinner Townships (Twp.), an unincorporated area of Franklin County, Maine. At the time the study was conducted, up to four ridgelines were under consideration for turbine locations, 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 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.

In order to characterize species migrating through the project area during the night, TransCanada performed foraging migrant surveys in the proposed project area.

1.1 Objectives

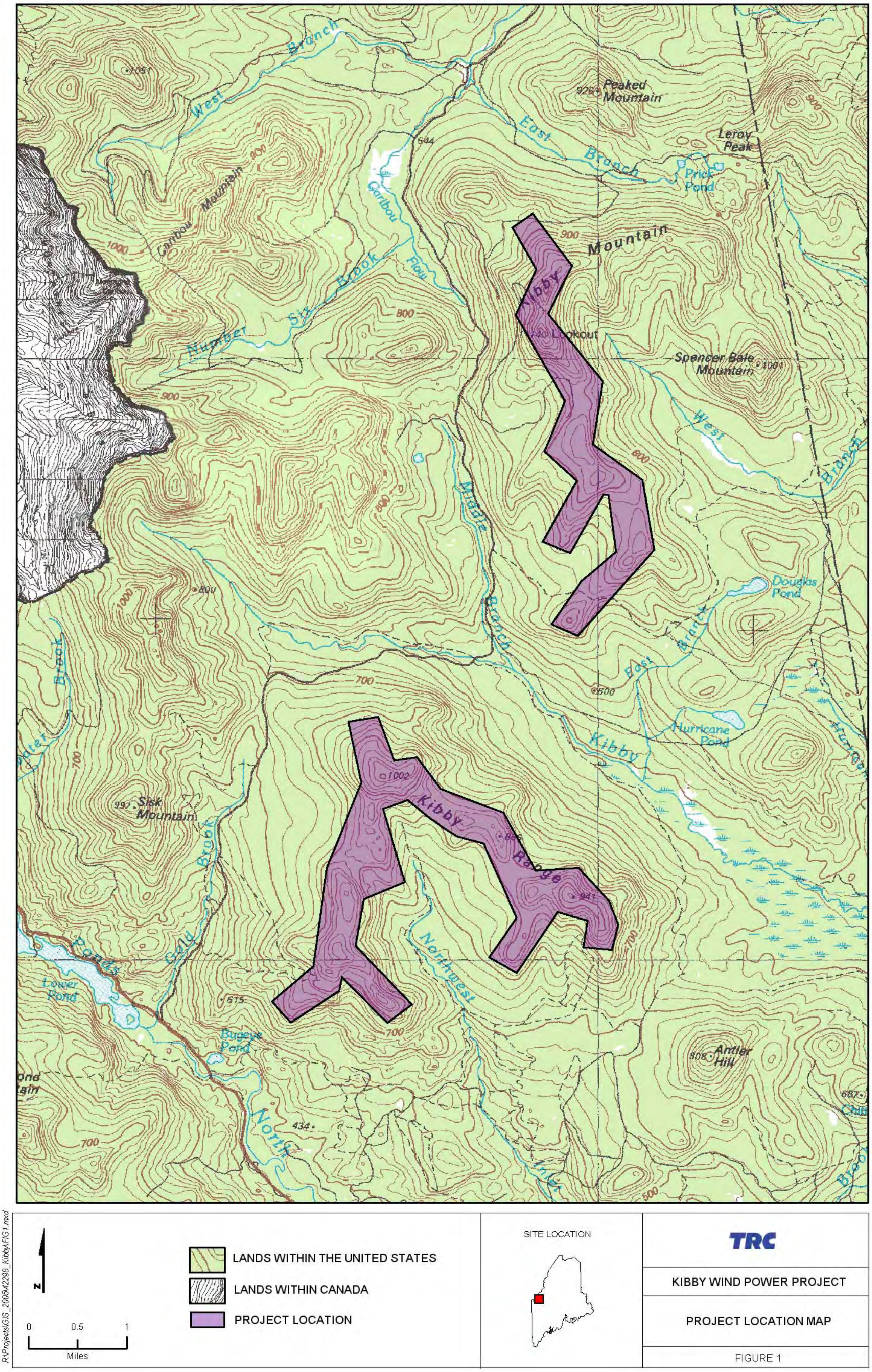
The main objectives of spring 2006 foraging surveys were to:

- 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.

1.2 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 3.1.1. Where appropriate, current data will be compared with data collected during these earlier studies in the report. TransCanada also conducted a foraging migrant study in the fall of 2005.

Figure 1: Project Location



2.0 STUDY METHODOLOGY

2.1 Survey Protocol

2.1.1 Protocol Development

Basic methodologies for spring 2006 surveys were the same as those employed during the fall 2005 surveys (TRC 2005). Likewise, these methodologies were similar to those used for surveys conducted in the spring and fall of 1994 for U.S. Windpower (ND&T 1994a, 1994b, 1995a and 1995b). In 2005 and 2006, however, a greater amount of effort was expended than in previous studies. Specifically, 4 transects were surveyed in 2005 and 2006, as opposed to only 3 in spring and 2 in fall 1994. These additional transects increased the overall units of effort ([length of transect] x [number of visits]) expended in 2005 and 2006 (as compared to 1994 efforts).

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.

In February and April 2006, further discussions were held with Tom Hodgman regarding spring 2006 field studies. The outcome of these discussions was to perform the spring 2006 surveys in the same way as they were conducted in the fall of 2005.

2.1.2 Survey Site Locations

Four survey transects were selected for spring 2006 foraging surveys. These same four transects were used for the fall 2005 foraging surveys (Figures 2 and 3). Each was mapped and its length calculated using a Global Position System (GPS). Transects were selected based on being located in representative habitat for the area , as well as having adequate access.

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 680m and 700m (2,230ft and 2,300ft) elevation. The Kibby Mountain valley transect was located along a jeep trail, between approximately 780m and 823m (2,560ft and 2,700ft) elevation.

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 823m and 1,000m (2,700ft and 3,281ft) elevation. The Kibby

Mountain ridge transect was located along a jeep trail, between approximately 957m and 1,114m (3,140ft and 3,654ft) 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).

Figure 2: Kibby Mountain Transect Locations

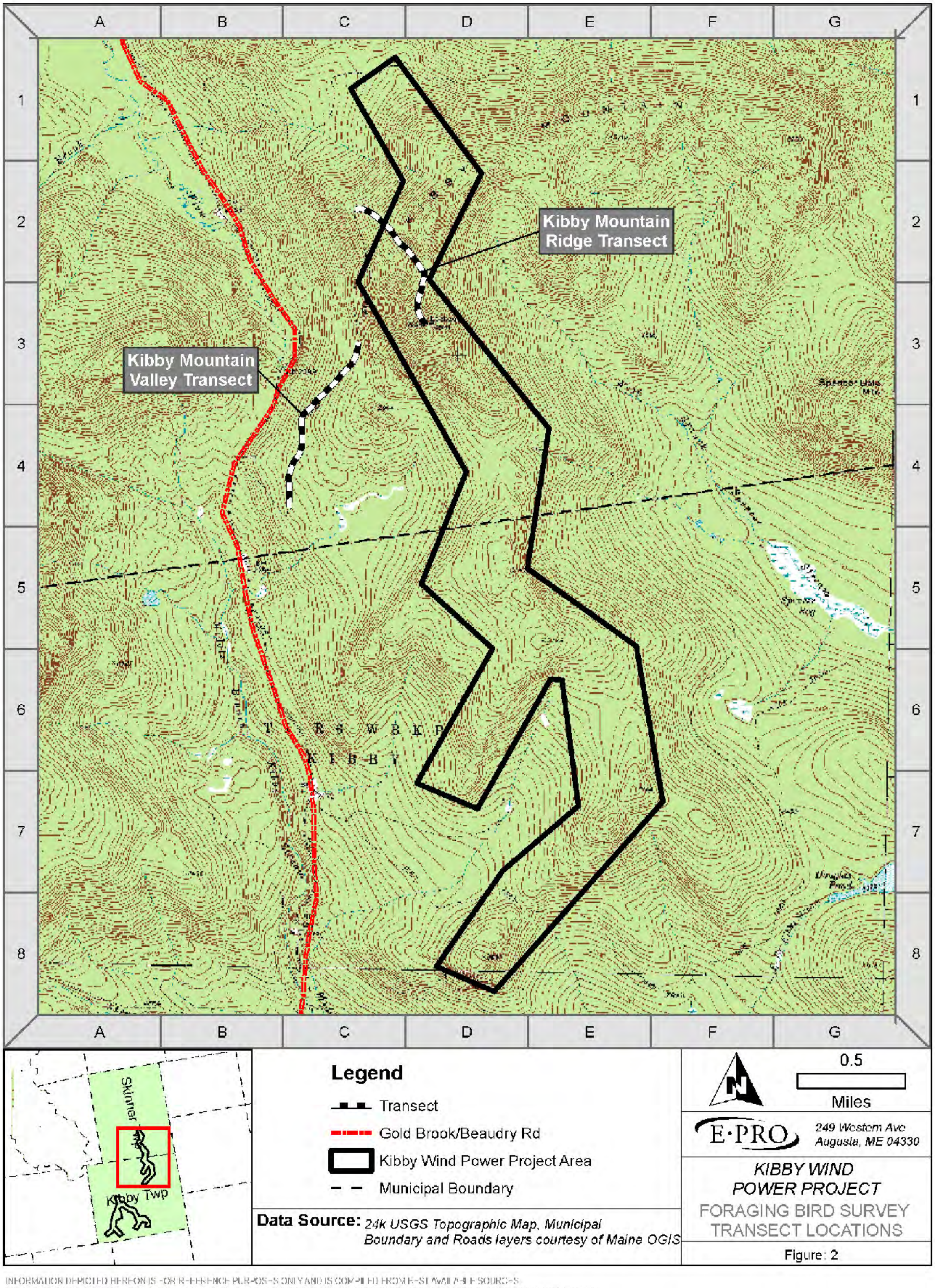
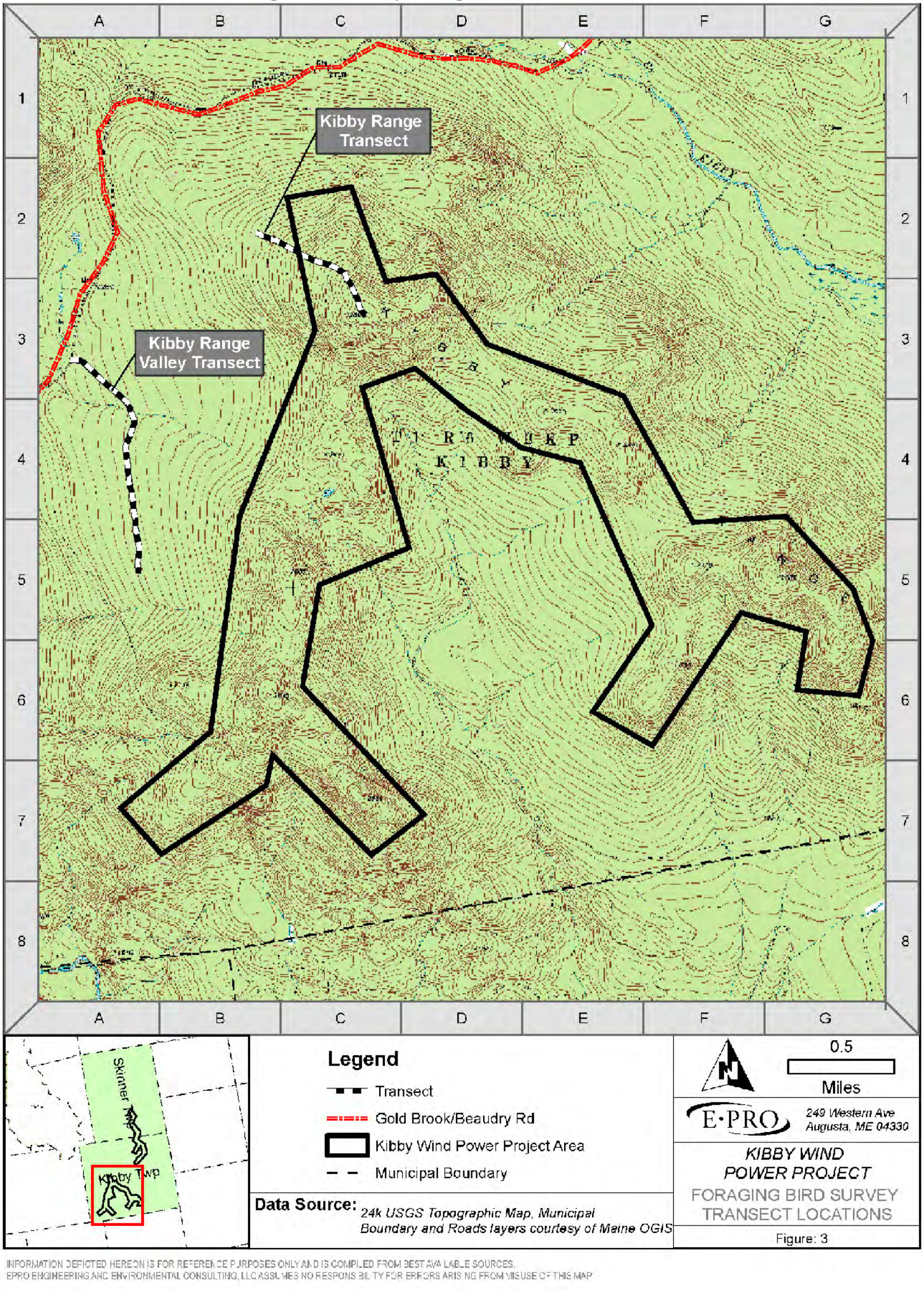


Figure 3: Kibby Range Transect Locations



2.1.3 General Survey Procedure

The surveys were performed by one observer walking slowly along a transect early in the morning of each of the survey dates. One afternoon survey was conducted to observe foraging birds, after a morning survey was abbreviated due to deteriorating weather conditions and little bird activity. 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 (i.e. foraging, vocalizing, etc.) and the substrate on which they were observed (i.e., substrate: ground, shrubs, trees, etc.) were noted.

2.1.4 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. During the spring 2006, weather was rainy and foggy on many mornings, and one afternoon survey was performed after the typical morning survey was discontinued.

Surveys were performed on nine dates between May 4 and May 27. Twenty-one individual transect surveys were completed over the course of these dates. See section 3.1, Table 1 for further details.

2.1.5 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.

2.1.6 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.

2.1.6.1 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.).

2.1.6.2 Individual Bird Observations

For each bird observed during foraging surveys, the following information was recorded: species, behavior when first observed (foraging, vocalizing, flying, 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."

2.1.6.3 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.

2.1.6.4 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;
- Frequency of behaviors observed; and
- Temporal use by migrant species

In addition, the following statistical analyses were conducted in order to address the objectives and goals of this study:

- Shannon-Weiner Diversity Index and Equitability;
- Community Similarity;
- Statistical Evaluation of Observed Differences in Diversity; and

- Statistical Evaluation of Observed Differences in the Numbers of Individuals.

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 ($H_{max} = \ln S$):

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

A diversity index of 3.0 or above is suggestive of excellent diversity, while values below 1.5 generally reflect poor community diversity. Those diversity values that fall between 1.5 to 3.0 are indicative of moderate community diversity.

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:

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

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: $\lambda_i = \dfrac{\sum_{k=1}^{S} x_{ik} (x_{ik} - 1)}{N_i (N_i - 1)}$

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

SAS (Version 8.2) (SAS Institute 1999-2001) was used to conduct all analyses. Statistically significant results are reported where $p<0.05$ alpha probability levels.

The significance of the differences in the numbers of organisms across sites was evaluated with a χ^2 goodness–of–fit test. For the purposes of this analysis, the expected numbers of organisms (N_{EXP}) at each site were weighted by the corresponding unit of effort (number of individuals/km) expended:

$$N_{EXP} = \frac{E_{SITE}}{\sum_{i=1}^{4} E_{SITE}} * \sum_{i=1}^{4} N_{OBS}$$

where:

E_{SITE} = Unit of effort expended at the site; and
N_{OBS} = Number of observed individuals.

Statistically significant differences in Shannon-Weiner diversity indices between sites were first assessed with a non-parametric Kruskal-Wallis ANOVA with a *post hoc* Mann-Whitney U-test (U_A). The *post hoc* test was used to examine paired differences in the ranks of two samples only if the Kruskal-Wallis test generated a statistically significant result. The values used in the across – site comparison included the individual H values calculated for each species at each site.

3.0 RESULTS AND DISCUSSION

3.1 Daytime Avian Foraging Surveys

Surveys were performed on nine dates between May 4 and May 27. In all, 21 transect surveys were performed during the spring 2006 season. The dates on which each transect was visited are listed on Table 1.

Table 1: Dates of Spring 2006 Survey Events

Date	Transect			
	Kibby Mountain Valley	Kibby Mountain Ridge	Kibby Range Valley	Kibby Range Ridge
4-May	X	X	X	X
9-May			X	X
10-May	X	X		
18-May			X	
23-May	X	X		X
24-May			X	X
25-May	X	X		
26-May	X	X	X	X
27-May				X
Total Visits	**5**	**5**	**5**	**6**

3.1.1 Species Lists, and Indices of Bird Relative Abundance

A total of 607 individual birds, representing 46 species, from 17 families were observed during these surveys (Table 2). The most frequently observed species was the white-throated sparrow, with a relative abundance of 19.1 percent. The next most frequently observed species were yellow-rumped warblers (11.4 percent), winter wrens (10.9 percent), and dark-eyed juncos (9.4 percent).

Birds in the warbler family (*Parulidae*) comprised the most frequently observed genre. A total of 15 species of warblers collectively represented 31.1 percent of all birds recorded. Birds in the sparrow family (*Emberizidae*) were second most frequently observed with 5 total species collectively comprising 29.2 percent of all observations. Winter wrens (*Troglodytidae*) alone comprised the third most abundant family, representing 10.9 percent of all birds recorded. The remaining families were observed much less frequently, with relative abundances ranging from 0.2 percent to 6.8 percent. Note that the three most abundant families observed are largely comprised of migratory species. It should also be noted, however, that many of these species are also potential breeders in the project vicinity.

Table 2: Species List and Relative Abundance

Family	Species (common name)	Species (Latin name)	Status 2	#	Relative Abundance
Certhiidae	Brown creeper	*Certhia americana*	PR	8	1.3%
Subtotal:				***8***	***1.3%***
Corvidae	Blue jay	*Cyanocitta cristata*	PR	2	0.3%
	Gray jay	*Perisoreus canadensis*	PR	4	0.7%
Subtotal:				***6***	***1.0%***
Emberizidae	Chipping sparrow	*Spizella passerina*	M/B	2	0.3%
	Dark-eyed junco	*Junco hyemalis*	M/B to PR	57	9.4%
	Fox sparrow	*Passerella iliaca*	M/B	1	0.2%
	Song sparrow	*Melospiza melodia*	M/B	1	0.2%
	White-throated sparrow	*Zonotrichia albicollis*	M/B	116	19.1%
Subtotal:				***177***	***29.2%***
Fringillidae	American goldfinch	*Carduelis tristis*	PR	4	0.7%
	Purple finch	*Carpodacus purpureus*	PR	3	0.5%
Subtotal:				***7***	***1.2%***
Hirundinidae	Tree swallow	*Tachycineta bicolor*	M/B	1	0.2%
Subtotal:				***1***	***0.2%***
Icteridae	Rusty blackbird [1]	*Euphagus carolinus*	M/B	2	0.3%
Subtotal:				***2***	***0.3%***
Mimidae	Gray catbird	*Dumetella carolinensis*	M/B	4	0.7%
Subtotal:				***4***	***0.7%***
Paridae	Black-capped chickadee	*Poecile atricapillus*	PR	14	2.3%
	Boreal chickadee	*Poecile hudsonica*	PR	14	2.3%
Subtotal:				***28***	***4.6%***
Parulidae	American redstart	*Setophaga ruticilla*	M/B	14	2.3%
	Bay-breasted warbler	*Dendroica Castanea*	M/B	4	0.7%
	Blackburnian warbler	*Dendroica fusca*	M/B	3	0.5%
	Blackpoll warbler	*Dendroica striata*	M/B	26	4.3%
	Black-throated blue warbler	*Dendroica caerulescens*	M/B	11	1.8%
	Black-throated green warbler	*Dendroica virens*	M/B	18	3.0%
	Chestnut-sided warbler	*Dendroica pensylvanica*	M/B	3	0.5%
	Common yellowthroat	*Geothlypis trichas*	M/B	8	1.3%
	Connecticut warbler	*Oporornis agilis*	M	1	0.2%
	Golden-winged warbler	*Vermivora chrysoptera*	M	1	0.2%
	Magnolia warbler	*Dendroica magnolia*	M/B	25	4.1%
	Nashville warbler	*Vermivora ruficapilla*	M/B	1	0.2%
	Tennessee warbler	*Vermivora peregrina*	M/B	3	0.5%
	Yellow warbler	*Dendroica petechia*	M/B	2	0.3%
	Yellow-rumped warbler	*Dendroica coronata*	M/B	69	11.4%
Subtotal:				***189***	***31.1%***
Phasianidae	Ruffed grouse	*Bonasa umbellus*	PR	19	3.1%
Subtotal:				***19***	***3.1%***

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Table 2: Species List and Relative Abundance (Continued)					
Picidae	Black-backed woodpecker	*Picoides arcticus*	PR	3	0.5%
	Downy woodpecker	*Picoides pubescens*	PR	3	0.5%
	Hairy woodpecker	*Picoides villosus*	PR	4	0.7%
	Northern flicker	*Colaptes auratus*	M/B	3	0.5%
	Pileated woodpecker	*Dryocopus pileatus*	PR	2	0.3%
	Yellow-bellied sapsucker	*Sphyrapicus varius*	M/B	4	0.7%
Subtotal:				***19***	***3.1%***
Regulidae	Golden-crowned kinglet	*Regulus satrapa*	M/B to PR	27	4.4%
	Ruby-crowned kinglet	*Regulus calendula*	M/B	14	2.3%
Subtotal:				***41***	***6.8%***
Sittidae	Red-breasted nuthatch	*Sitta canadensis*	PR	1	0.2%
Subtotal:				***1***	***0.2%***
Troglodytidae	Winter wren	*Troglodytes troglodytes*	M/B	66	10.9%
Subtotal:				***66***	***10.9%***
Turdidae	American robin	*Turdus migratorius*	M/B	6	1.0%
	Hermit thrush	*Catharus guttatus*	M/B	5	0.8%
	Swainson's thrush	*Catharus ustulatus*	M/B	12	2.0%
	Thrush sp.	*Catharus sp.*	M/B	2	0.3%
Subtotal:				***25***	***4.1%***
Tyrannidae	Yellow-bellied flycatcher	*Empidonax flaviventris*	M/B	2	0.3%
Subtotal:				***2***	***0.3%***
Vireonidae	Blue-headed vireo	*Vireo solitarius*	M/B	12	2.0%
Subtotal:				***12***	***2.0%***
TOTALS				**607**	**100.0%**
[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 during spring 2006 are consistent with observations recorded in spring/fall 1994 and fall 2005, with sparrows and warblers topping the list. White-throated sparrows (a migratory species that potentially breeds in the project vicinity) were among the most commonly observed species in each of the studies. In 2006, yellow-rumped warblers moved up in relative abundance from fall observations to replace golden-crowned kinglets as the second most frequently recorded species. Also in spring 2006, winter wrens, which were not in enumerated among most frequent species during previous studies, comprised a top species in abundance. Meanwhile, chickadees and kinglets (which were among the most frequent species in previous fall studies) dropped off the spring list for most frequently observed species; this is consistent with spring 1994 observations. (ND&T 1994a, 1994b, 1995a, and 1995b; TRC 2005).

No threatened or endangered species were identified during spring 2006 surveys. However, one of the species identified, the rusty blackbird, is listed as a Species of Special Concern in the state of Maine.

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.

Rusty blackbirds are potential breeders in Kibby and Skinner Townships, and are migrants. They are not 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 453 (74.6 percent) of the 607 birds observed performing vocalizations (see Table 3). This is not surprising as many birds are in breeding condition in the spring and sing frequently during migration. Vocalization is also often associated with flocking and foraging, which are common behaviors during migratory stopovers. Foraging was the second most common behavior recorded at 25.5 percent. Foraging behavior is to be expected because the three most abundant families observed were migratory species which typically forage during stopovers to replenish energy lost in flight.

Table 3: Frequency of Behaviors Observed

Family	#	Behavior			
		Flying	Foraging	Vocalizing	Other
Certhiidae	8	0	2	8	0
Corvidae	6	1	4	3	0
Emberizidae	177	2	62	125	23
Fringillidae	7	5	0	7	0
Hirundinidae	1	1	1	0	0
Icteridae	2	0	1	0	1
Mimidae	4	4	0	0	0
Paridae	28	4	19	17	0
Parulidae	189	3	35	164	7
Phasianidae	19	0	0	0	19
Picidae	19	3	10	5	6
Regulidae	41	1	13	36	0
Sittidae	1	0	0	0	1
Troglodytidae	66	0	5	63	2
Turdidae	25	7	1	12	8
Tyrannidae	2	0	0	2	0
Vireonidae	12	0	2	11	0
TOTALS	607	31	155	453	67
%of 607 total		5.1%	25.5%	74.6%	11.0%

Note: birds that were observed to perform multiple activities were recorded as such.

3.1.2.2 Avian Use by Substrate

Trees were the most frequently used substrate, with 47.1 percent of all birds observed using trees (see Table 4). The ground was the next most utilized substrate, with 13.5 percent of all birds observed using the ground. It should be noted that many of the species observed forage by gleaning foliage or tree bark (Ehrlich et al. 1988). 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**						
		Gr	DeSh	CoSh	DeTr	CoTr	MiTr	U
Certhiidae	8	0	0	0	1	1	0	6
Corvidae	6	0	0	0	0	5	0	1
Emberizidae	177	55	8	11	10	51	6	36
Fringillidae	7	0	0	0	0	0	0	7
Hirundinidae	1	0	0	0	0	0	0	1
Icteridae	2	1	0	0	0	1	0	0
Mimidae	4	0	0	0	0	0	0	4
Paridae	28	0	0	2	5	17	2	2
Parulidae	189	0	1	3	32	50	17	86
Phasianidae	19	13	0	0	0	0	0	6
Picidae	19	0	0	0	11	5	0	3
Regulidae	41	0	0	3	3	17	11	7
Sittidae	1	0	0	0	0	0	0	1
Troglodytidae	66	5	0	8	2	14	12	25
Turdidae	25	8	1	1	2	4	1	8
Tyrannidae	2	0	0	0	0	1	0	1
Vireonidae	12	0	0	0	2	2	1	7
TOTALS	607	82	10	28	68	168	50	201
%of 607 total		13.5%	1.6%	4.6%	11.2%	27.7%	8.2%	33.1%

Gr = ground, DeSh = deciduous shrub, CoSh = coniferous shrub, DeTr = deciduous tree, CoTr = coniferous tree, MiTr = mixed trees, U = unknown (vocalizing only)

3.1.3 Distribution by Habitat Type (Site)

3.1.3.1 Habitat Descriptions by Site

<u>Kibby Range Valley</u>
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.

<u>Kibby Range Ridge</u>
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.

<u>Kibby Mountain Valley</u>
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.

<u>Kibby Mountain Ridge</u>
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). Parulids (warblers) were observed more frequently in the valleys than on their relative ridges, with comparatively more frequent observations in Kibby Range valley. Regulids (kinglets) were observed more frequently in Kibby Mountain valley than at other transects. Emberizids (sparrows), Parulids (warblers), Turdids (thrushes), Vireonids (vireos) 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 (15 total families), while Kibby Mountain ridge had the lowest (9 families). Kibby Range ridge and Kibby Mountain valley supported 13 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
Certhiidae	8	3	1	1	1	1	1	3	1
Corvidae	6	-	-	1	1	-	-	5	1
Emberizidae	177	17	1	36	1	74	1	50	1
Fringillidae	7	-	-	1	1	4	1	2	1
Hirundinidae	1	-	-	-	-	1	1	-	-
Icteridae	2	-	-	-	-	2	1	-	-
Mimidae	4	-	-	-	-	4	1	-	-
Paridae	28	4	1	5	1	9	1	10	1
Parulidae	189	44	1	19	1	86	1	40	1
Phasianidae	19	8	1	-	-	7	1	4	1
Picidae	19	2	1	-	-	14	1	3	1
Regulidae	41	24	1	6	1	7	1	4	1
Sittidae	1	1	1	-	-	-	-	-	-
Troglodytidae	66	19	1	4	1	20	1	23	1
Turdidae	25	7	1	1	1	13	1	4	1
Tyrannidae	2	-	-	-	-	1	1	1	1
Vireonidae	12	3	1	-	-	7	1	2	1
TOTAL INDIVIDUALS	607	132		74		250		151	
TOTAL FAMILIES	17		11		9		15		13

The Kibby Range transects yielded higher average observations per unit effort than the Kibby Mountain transects. The Kibby Range valley transect had the highest number of observations per unit effort from among all locations (see Table 6).

Table 6: Average Observations per Unit Effort, by Site

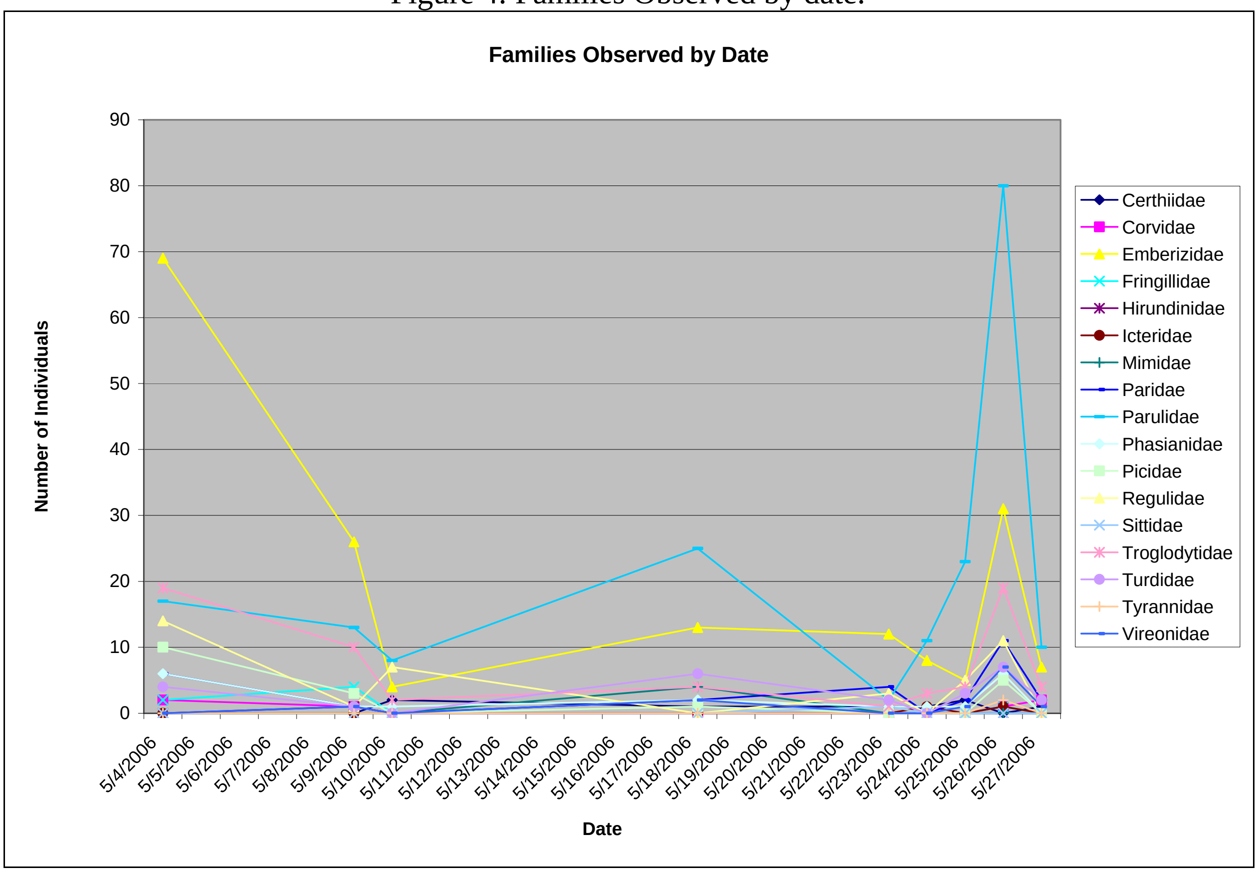
Location	Length (km)	Number of Visits	Total Birds Observed	Average per Visit	Units Effort (Length x No. Visits)	Average per km
Kibby Mountain Valley	1.5	5	132	26.40	7.50	17.60
Kibby Mountain Ridge	1.25	5	74	14.80	6.25	11.84
Kibby Range Valley	1.9	5	250	50.00	9.50	26.32
Kibby Range Ridge	1.18	6	151	25.17	7.08	21.33

3.1.4 Temporal Use by Migrant Species

Many migratory species were observed during spring 2006 foraging bird surveys, however they were generally dominated by members of three families. These include the Parulids (warblers), Emberizids (sparrows), and Troglodytids (wrens).

In general, Emberizids peaked early, tapering by mid-season with a small peak late in the month. Parulids remained fairly consistent and moderate in numbers over the course of the early and mid season, followed by a sharp peak in numbers late in the month. Troglodytids and several other families show moderate numbers early in the month, followed by a mid-month plateau, then a slight peak late in the month.

Figure 4: Families Observed by date.



3.1.5 Patterns in the Nature of the Avian Community

3.1.5.1 Numbers of Organisms

The numbers of organisms (birds) observed at each site were evaluated with a chi-square test designed to determine whether the numbers of organisms were occurring randomly (by chance) or if there was a distinct pattern. The purpose of this test is to crudely determine of species are preferentially using one site over the other and based upon the results this certainly appears to be the case.

There is a statistically significant difference in the numbers of organisms observed across sites (*p* 0.0001) (Table 7). The highest number of individuals was observed at the Kibby Range valley site, whereas the lowest number of individuals was observed at the Kibby Mountain Ridge site.

Table 7: Results of χ^2 analysis

Location	Birds Observed	Unit of Effort (Length x No. Visits)	Birds Expected	Expected Proportion	Percentage Deviation (%)	Standardized Residuals
Kibby Mountain Valley	132	7.5	150.10	0.247	-12.06	-1.48
Kibby Mountain Ridge	74	6.25	125.08	0.206	-40.84	-4.57
Kibby Range Valley	250	9.5	190.13	0.313	+31.49	+4.34
Kibby Range Ridge	151	7.08	141.69	0.233	+6.57	+0.78
TOTALS	607	30.33	607	1.0	--	--
χ^2 statistic	42.51					
Degrees of freedom	3					
p-value	0.0001					

3.1.5.2 Shannon-Weiner Diversity

The Shannon-Weiner index is designed specifically to look at both the numbers of organisms and the numbers of different species. In general, those communities that are dominated by very high numbers of only one or few species are typically observed in extremely disturbed environmental conditions. Conversely, those communities that are comprised of high numbers of species that are equally represented are said to be relatively healthy and that reflect excellent habitat conditions.

Of the individual sites examined, the highest diversity index (H) was observed at the Kibby Range valley site (2.94), followed by the Kibby Range ridge site, and then the Kibby Mountain valley site (Table 8). The lowest avian community diversity index was observed on Kibby Mountain ridge (2.0). Given these diversity values, the Kibby Range valley site exhibits excellent diversity, while the Kibby Range ridge and Kibby Mountain valley demonstrate moderate diversity. The avian community at the Kibby Mountain ridge site is considered to be characterized by low diversity. Community evenness (J) is comparably 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.

With respect to the differences between comparable site types, the Kibby Range valley site is more diverse, species rich, and contains a greater number of organisms than the Kibby Mountain valley site. This pattern also holds true in a comparison of the two ridge sites, whereby the Kibby Range ridge site exhibits greater diversity, species richness, and greater numbers of organisms than the Kibby Mountain ridge site.

Based upon the pooled analysis, valleys are more diverse than the ridge counterparts, and exhibit higher evenness, species richness, and numbers of organisms.

Table 8: Community Metrics Across Sites (Shannon–Weiner)

Site	Diversity (H)	Evenness (J)	Species Richness (R)	Number of Organisms (N)
Kibby Range Valley	2.94	0.81	38	250
Kibby Range Ridge	2.61	0.81	25	151
Kibby Mountain Valley	2.51	0.82	21	132
Kibby Mountain Ridge	2.00	0.80	12	74
Pooled Valley	3.06	0.81	43	382
Pooled Ridge	2.52	0.78	25	225

3.1.5.3 Mann-Whitney and Kruskal-Wallis Tests

Based upon the results of the Shannon-Weiner analysis, certain sites offer far more suitable habitat that others and this is clearly borne out in the data. Specifically, the Kruskal-Wallis ANOVA, which examines the median Shannon-Weiner diversity index observed across all sites simultaneously, indicates that there is a difference. The Mann-Whitney test, which is used to pinpoint the exact site pairs that are responsible for the significant difference indicates that the differences in the median H-values are largely driven by the B-Range Valley and Kibby Mountain Ridge pair.

With respect to the Mann–Whitney analysis of the individual H scores for each site, the Kibby Range valley site exhibited the highest mean score, while Kibby Mountain ridge exhibited the lowest (Table 9). The Kruskal–Wallis test result indicates that there are significant differences in the H values between each of the four sites examined (p 0.016).

Table 9: Summary of Mann-Whitney Scores and Kruskal–Wallis Test Results

Site	N	Sum of Scores	Expected under null hypothesis (H_o)	SD under null hypothesis (H_o)	Mean Score
Kibby Range Valley	38	2,190	1,843	133.31	57.63
Kibby Range Ridge	25	1,234	1,212	119.64	49.36
Kibby Mountain Valley	21	853	1,018	112.69	40.61
Kibby Mountain Ridge	12	379	582	90.15	31.58
Kruskal-Wallis ANOVA	Chi-square = 10.23				
	Degrees of Freedom (df) = 3				
	$p = 0.016$				

The *post hoc* Mann–Whitney test shows that the statistically significant difference yielded by the Kruskal–Wallis is largely attributable to the difference between the Kibby Mountain ridge and the Kibby Range valley sites (p 0.004) (Table 10).

Although not quite as pronounced, one other significant difference in diversity (H) was observed between the Kibby Mountain valley and Kibby Range valley sites (p 0.04). It is also worth noting that the difference between Kibby Mountain ridge and Kibby Range ridge was weakly, yet not statistically significant (p>0.050). No other significant differences were observed between sites.

Table 10: 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	0.09	--			
Kibby Range Valley	NA	NA	--		
Kibby Range Ridge	NA	NA	0.19	--	
Kibby Mountain Valley	NA	NA	**0.04**	0.23	--
Kibby Mountain Ridge	NA	NA	**0.004**	0.053	0.56

The following sections discuss the results of the avian community similarity analysis, which shed even more light on the observed differences in the avian assemblage across sites.

3.1.5.4 Morisita Index of Similarity

As the final piece in the suite of analyses, the Morisita similarity index examines the extent to which each community can be said to be similar to another community. Typically, those communities that exhibit marked differences in species composition may be reflecting different disturbance regimes or other habitat differences. Those communities that are similar in terms of avian species composition can be said to most likely be similar in terms of habitat properties as well, e.g. plant community composition, soil properties etc., although differences in habitat use both with ontogeny and avian species cannot be ruled out.

The highest degree of similarity was observed between the Kibby Range ridge and Kibby Range valley sites, which was followed closely by the Kibby Mountain ridge and Kibby Range ridge sites (Table 11). The remaining sites exhibited moderate to low degrees of avian community similarity.

The low similarity index between the Kibby Range valley and the Kibby Mountain valley sites indicates that species composition is different at the two sites and is potentially suggestive of habitat differences.

Table 11: Morisita Similarity Index Matrix

Site	**Kibby Range Valley**	**Kibby Range Ridge**	**Kibby Mountain Valley**	**Kibby Mountain Ridge**
Kibby Range Valley	--			
Kibby Range Ridge	0.885	--		
Kibby Mountain Valley	0.394	0.626	--	
Kibby Mountain Ridge	0.581	0.833	0.596	--

3.1.5.5 Patterns in Species Distribution

As previously discussed, the most noticeable and statistically significant differences observed across the sites with respect to Shannon–Weiner diversity (H) occurred between Kibby Mountain ridge and Kibby Range valley, in addition to Kibby Range valley and Kibby Mountain valley. This latter site pair also exhibited the most pronounced difference with respect to the Morisita index.

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 12). Specifically, the differences between Kibby Mountain ridge and Kibby Range valley are largely attributable to the greater numbers of species including the American redstart, black throated green warbler, magnolia warbler, white throated sparrow, and the winter wren at the Kibby Range valley site. With respect to the Kibby Mountain ridge site, greater numbers of dark eyed junco were observed, but more significantly is the relatively large number of zero values. In short, far fewer species were observed at the Kibby Mountain ridge site.

Table 12: Morisita Raw Data Summary (including Absence Data)

Species	#	Kibby Range Ridge	Kibby Range Valley	Kibby Mountain Ridge	Kibby Mountain Valley
American Goldfinch	4	2	1	1	0
American Redstart	14	3	11	0	0
American Robin	6	1	5	0	0
Bay Breasted Warbler	4	0	0	0	4
Black Backed Woodpecker	3	3	0	0	0
Black Capped Chickadee	14	2	8	0	4
Black Throated Blue Warbler	11	2	6	1	2
Black Throated Green Warbler	18	0	12	0	6
Blackburnian Warbler	3	1	0	0	2
Blackpoll Warbler	26	12	7	6	1
Blue Headed Vireo	12	2	7	0	3
Blue Jay	2	1	0	1	0
Boreal Chickadee	14	8	1	5	0
Brown Creeper	8	3	1	1	3
Chestnut Sided Warbler	3	0	3	0	0
Chipping Sparrow	2	0	2	0	0
Common Yellowthroat	8	0	8	0	0
Connecticut Warbler	1	1	0	0	0
Dark Eyed Junco	57	16	4	22	15
Downy Woodpecker	3	0	3	0	0
Fox Sparrow	1	0	1	0	0
Golden Crowned Kinglet	27	3	2	0	22
Golden Winged Warbler	1	0	1	0	0
Gray Catbird	4	0	4	0	0
Gray Jay	4	4	0	0	0
Hairy Woodpecker	4	0	2	0	2
Hermit Thrush	5	0	5	0	0
Magnolia Warbler	25	4	19	0	2
Nashville Warbler	1	0	1	0	0
Northern Flicker	3	0	3	0	0
Pileated Woodpecker	2	0	2	0	0
Purple Finch	3	0	3	0	0
Red Breasted Nuthatch	1	0	0	0	1
Ruby Crownwd Kinglet	14	1	5	6	2
Ruffed Grouse	19	4	7	0	8
Rusty Blackbird	2	0	2	0	0
Song Sparrow	1	0	1	0	0
Swainson's Thrush	12	3	3	1	5

Continued on next page

Species	#	Kibby Range Ridge	Kibby Range Valley	Kibby Mountain Ridge	Kibby Mountain Valley
Table 12: Morisita Raw Data Summary…(Continued)					
Tennessee Warbler	3	2	0	0	1
Thrush sp.	2	0	0	0	2
Tree Swallow	1	0	1	0	0
White Throated Sparrow	116	34	66	14	2
Winter Wren	66	23	20	4	19
Yellow Bellied Flycatcher	2	1	1	0	0
Yellow Bellied Sapsucker	4	0	4	0	0
Yellow Rumped Warbler	69	15	16	12	26
Yellow Warbler	2	0	2	0	0
SUM	**607**	**151**	**250**	**74**	**132**

4.0 SUMMARY OF FINDINGS

A total of 607 individual birds, representing 46 species, from 17 families were observed during these surveys. The most frequently observed species was the white-throated sparrow, with a relative abundance of 19.1 percent. The next most frequently observed species were yellow-rumped warblers (11.4 percent), winter wrens (10.9 percent), and dark-eyed juncos (9.4 percent).

Birds in the warbler family (*Parulidae*) were most frequently observed. A total of 15 species of warblers collectively represented 31.1 percent of all birds recorded. Birds in the sparrow family (*Emberizidae*) were second most frequently observed with 5 total species collectively comprising 29.2 percent of all observations. Winter wrens (*Troglodytidae*) alone comprised the third most abundant family, representing 10.9 percent of all birds recorded. The remaining families were observed much less frequently, with relative abundances ranging from 0.2 percent to 6.8 percent. Note that the three most abundant families observed are largely comprised of migratory species.

Vocalization (call note utterance) was the most frequently observed behavior, with 453 (74.6 percent) of the 607 birds observed performing vocalizations. Foraging was the second most common behavior recorded at 25.5 percent.

Trees were the most frequently used substrate, with 46.9 percent of all birds observed using trees. The ground was the next most utilized substrate, with 13.5 percent of all birds observed using the ground.

The distribution of species varies with site. Parulids (warblers) were observed more frequently in the valleys than on their relative ridges, with comparatively more frequent observations in Kibby Range valley. Regulids (kinglets) were observed more frequently in Kibby Mountain valley than at other transects. Emberizids (sparrows), Parulids (warblers), Troglodytids (winter wrens), Turdids (thrushes), Verionids (vireos) 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 (15 total families), while Kibby Mountain ridge had the lowest (9 families). Kibby Range ridge and Kibby Mountain valley supported 13 and 11 families, respectively.

The Shannon-Weiner diversity index found that the highest species diversity was observed within Kibby Range valley, followed by Kibby Range ridge, then Kibby Mountain valley. The lowest diversity index was observed on Kibby Mountain ridge. Based on pooled analysis, it appears that the avian communities in valleys are more diverse and species rich than their ridge counterparts.

The Mann–Whitney test, which serves to pinpoint the exact site pairs that are responsible for the significant differences in median individual diversity index (H) scores for each site, demonstrates that the Kibby Range valley site exhibited the highest mean score, while Kibby Mountain ridge exhibited the lowest. Furthermore, a Kruskal–Wallis test indicates that there are significant differences in the H values between each of the four sites examined. A *post hoc* Mann–Whitney test shows that the statistically significant difference yielded by the Kruskal–Wallis is largely attributable to the difference between the Kibby Mountain ridge and the Kibby Range valley sites. Although not quite as pronounced, one other significant difference in diversity was observed between the Kibby Mountain valley and Kibby Range valley sites. It is also worth noting that the difference between Kibby Mountain ridge and Kibby Range ridge was weakly, yet not statistically significant. No other significant differences were observed between sites.

The Morisita Index of Similarity showed the highest degree of similarity between the Kibby Range ridge and Kibby Range valley sites, which was followed closely by the Kibby Mountain ridge and Kibby Range ridge sites (Table 11). The remaining sites exhibited moderate to low degrees of avian community similarity. The low similarity index between the Kibby Range valley and the Kibby Mountain valley sites indicates that species composition is different at the two sites and is potentially 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

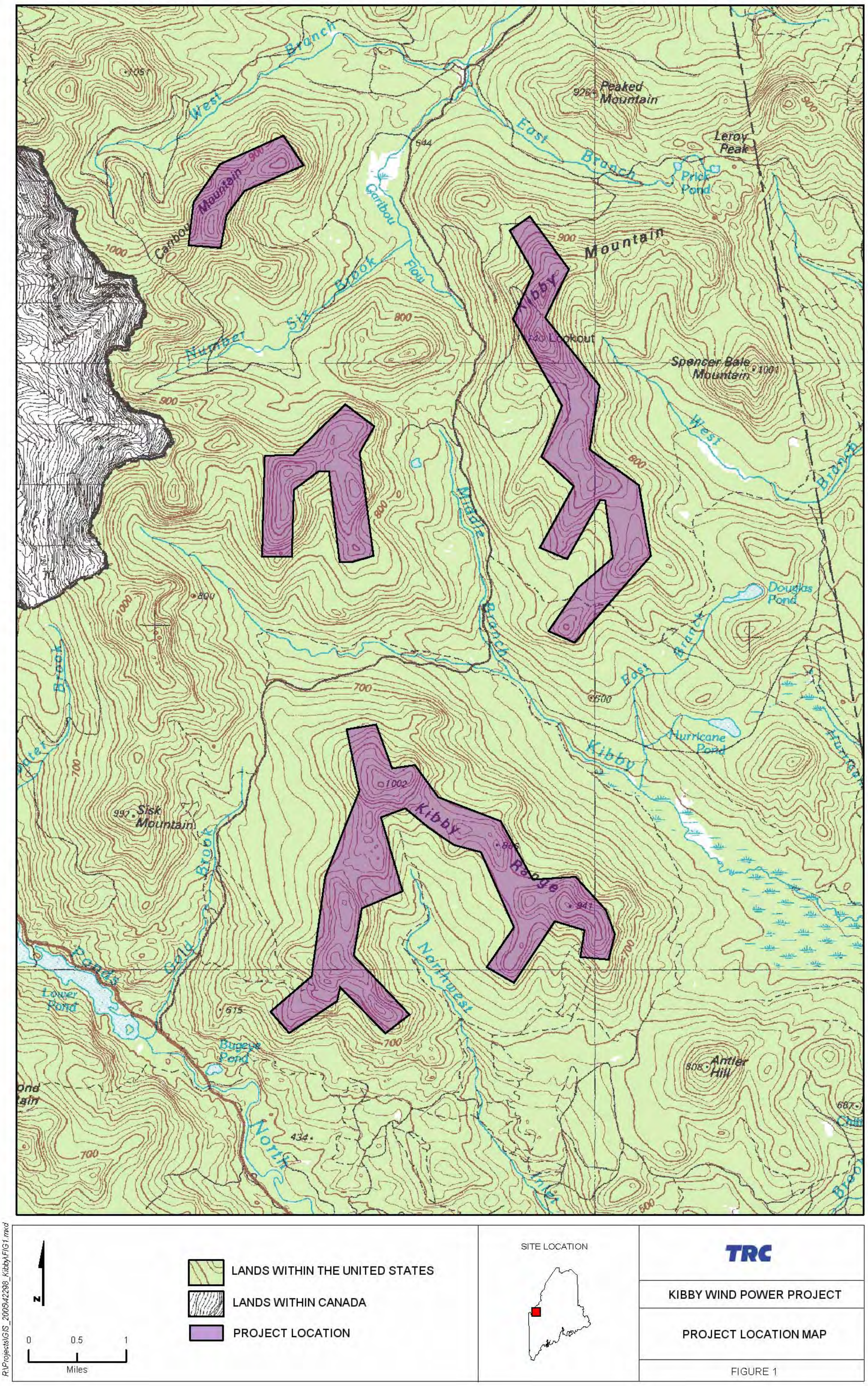
TransCanada Energy Ltd. (TransCanada) is proposing to develop, own and operate a 100–200 megawatt (MW) wind power generating facility in the Boundary Mountains of Western Maine known as the Kibby Wind Power Project. The project is in a location for which a similar project proposal by U.S. Windpower was 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			Comments
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: 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						
18						
19						
20						
21						
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**.

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