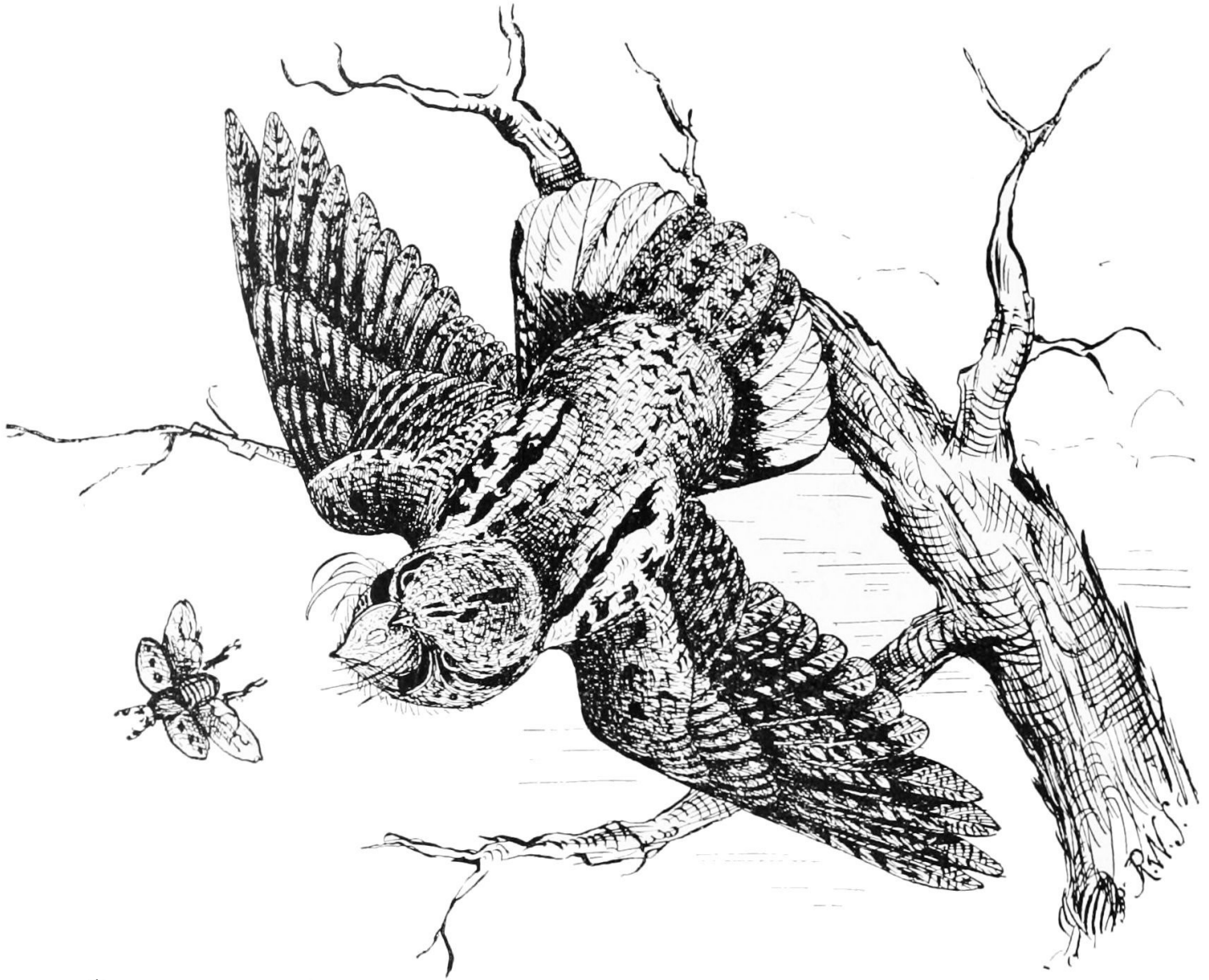


Maine Nightjar and Crepuscular Bird Monitoring Protocol

2019

January 2019, version 2.0



In Collaboration with the Maine Bird Atlas, a Project of
the Maine Department of Inland Fisheries and Wildlife



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Thank you for agreeing to participate in the Maine Nightjar and Crepuscular Bird Monitoring Project. The primary focus of this survey is collect data on two species of nightjars in Maine: Eastern Whip-poor-wills (*Antrostomus vociferus*) and Common Nighthawk (*Chordeiles minor*). These difficult to study species are thought to have declined severely in the past 50 years. The purpose of the survey is to collect information on the abundance and distribution of these species in Maine. In addition, we are asking volunteers to collect data on owls as well as other nocturnal and crepuscular bird species. These data will be used to track changes in distribution and to identify areas where these species may still be relatively abundant, to guide land protection efforts, habitat management, and future research and monitoring efforts.

This two-part survey will rely on volunteers to conduct standardized surveys along roadside survey routes during specific conditions. The only experience necessary is a familiarity with each species' characteristic songs (<https://www.mainenightjar.com>). It will also be helpful to be familiar with non-vocal sounds such as the “booming” display of the Common Nighthawk. Volunteers are asked to conduct a single sunset survey **and** a moonrise survey along pre-established routes between early May and mid-July (depending on location). For routes where Eastern Whip-poor-wills were detected during the first survey, we are asking volunteers to conduct a second moonrise survey between June 20 and July 6. Please read carefully and follow the instructions. Compliance with these instructions will ensure standardized data collection and a successful survey.

Conducting Surveys

Seasonal and Daily Timing:

Surveying nightjars is particularly challenging because they are known to be more vocal during the period around a full moon, and relatively quiet when the moon is poorly illuminated or below the horizon. For this reason, surveys are restricted as indicated below. In addition to only conducting surveys during the acceptable period, it is also important to **delay your moonrise survey (if needed) to allow the moon to rise above the horizon or to not be obscured by clouds**. This is most applicable during the waning moon (i.e., after the full moon), during which the moon rises progressively later each night. Eastern Whip-poor-will calling activity also declines during the course of the season, and is also reduced during cloudy conditions, except in for brief periods immediately after sunset or before sunrise. Picking a date and time for your survey will thus depend on several factors, including your location in Maine (Table 1), the lunar cycle in a given year (Table 2), and local weather conditions. **All routes must be run during the 1st lunar cycle (May 15 to May 26)**. Begin each sunset survey 45 minutes prior to sunset. Begin each moonrise survey *at least* 15 minutes after sunset and end no later than 15 minutes before sunrise. In most instances, the moonrise survey can immediately follow the sunset survey as long as there are suitable lunar and sky conditions. If conditions do not allow for running the nightjar survey on the same evening as the sunset survey, run the moonrise portion of the survey on the next possible evening.

Table 1. Latitudinal variation in spring arrival dates of the Eastern Whip-poor-will in Maine. Based on average arrival date, a survey period is defined based on a two-week delay until breeding and a six-week nesting period.

Nightjar Arrival date	Locations	Start of survey period	End of survey period
May 1	Southern Maine (south of Augusta)	May 15	June 25
May 10	Northern Maine (north of Augusta)	May 25	July 10



Table 2. Acceptable survey windows based on lunar phase for 2019. In this table, the full moon occurs on the last day of the waxing moon. Please compare this table with your location from Table 1 to determine the appropriate dates for conducting your survey.

Lunar phase	1st cycle	2nd cycle	3rd cycle (northern Maine only)
Waxing moon	May 15-18	June 10-17	N/A
Waning moon	May 19-26	June 18-25	July 9-10

If a nightjar is detected along a route in southern Maine during the first lunar cycle (May 15 – May 26), the route will need to be re-run during the 2nd lunar cycle (June 10 – June 25) to document the level of confidence that nightjars are breeding along the route. **Due to this year's lunar cycle, Northern Maine routes will have to be run initially during the tail end of the 1st lunar cycle (May 25 - 26) or during the 2nd lunar cycle.** If a nightjar is detected along a route in northern Maine during the first lunar cycle (May 25 – May 26) or the 2nd lunar cycle (June 10 – June 25), the route will need to be re-run during the 2nd lunar cycle (June 10 – June 25) or the 3rd lunar cycle (July 9 – July 10) to document the level of confidence that nightjars are breeding along the route. Sunset surveys **do not** need to be re-run during the 2nd cycle. **If you are unable to re-run your moonrise survey(s) during the 2nd lunar cycle (or 3rd lunar cycle for Northern Maine), contact Logan Parker (logan@hereinthewild.com).**

Note that the moon rises later each evening during these survey periods, and that by the end of the period a pre-dawn survey would be required. In such cases be sure to leave roughly 1.5 hours to complete the survey so that it ends before sunrise. It is **CRITICAL** that surveys are conducted during appropriate lunar conditions, irrespective of the date within the survey period. A table detailing sunrise, sunset, moonrise, and moonset can be found in the appendix (Appendix A).

Please reference the environmental conditions (wind, sky condition, and noise) sections below to determine when conditions are suitable for a survey.

Route Logistics:

Each route is to be surveyed twice during the first lunar cycle: once at dusk to survey crepuscular species and once after the moonrise to survey for Eastern Whip-poor-will and other night-calling bird species. The sunset survey should be timed to run approximately 45 minutes before to 45 minutes after sunset. The starting point for all surveys is stop number 1. All other stops are spaced approximately 1 mile apart along the route as indicated on your map (follow the UTM coordinates provided for each point). If the one-mile mark places you in a location that is not conducive to the survey (no place to pull off, excessive highway noise, barking dogs, directly in front of home, otherwise unsafe location), you may continue on for up to 1.2 miles (note this in the comment section and record the UTM location where you conducted your survey). Be sure to continue to the exact UTM coordinate for the next point. Please be sure to follow any instructions that accompany the provided map in such cases. If you are having trouble locating your route, contact the project coordinator so they can help you with directions. It is important you do this as soon as possible to ensure that the route is running in the first window.

Completing the Survey Forms:

There are three survey forms that will need to be completed during the first run of the route (during the 1st lunar cycle): the Sunset Survey Form, the Moonrise Survey Form, and the Survey Route De-



scription form. The instructions below outline the tables found on the survey forms. Please report data as accurately and completely as possible. You may want to conduct a test run on a date prior to your scheduled surveys so as to become familiar with the census techniques and the form. All three forms can be found following these instructions.

Survey Route Description Form: This form is used to gather data about habitat conditions along your survey route. It should be completed prior to your survey efforts at a time when habitat conditions are easily discernable. At each point, provide a general description of the point (visible within 100 meters), a count of the number of houses or other buildings, and the top 3 most dominant habitat types at the point. Habitat codes are listed at the bottom of the Survey Route Description Form. A more thorough explanation of habitat types can be found in the appendix (Appendix B).

Sunset and Moonrise Survey Forms: Both of these forms have the same format and use the same wind, sky condition, and noise data detailed in the tables below. Observation data should be entered on the survey form during their respective survey, however, environmental conditions should be noted at the point before commencing with your observations. Do not wait to enter your observation data until after the survey effort to avoid potential errors of omission.

Route Name: This should be on the map you receive from your coordinator.

Observer: Record your name here.

Date: Indicate the date of the survey.

Time Start: Indicate the time at which you begin listening at stop 1.

Time End: Indicate the time at which you stop listening at stop 10.

Environmental Conditions:

For each point, we are asking that you give an indication of the following environmental conditions. Use only the code systems detailed below. It is important to conduct surveys only under appropriate environmental conditions to ensure birds can be detected. Sunset surveys **cannot** be conducted when wind is a 3 or higher on the Beaufort Scale and during drizzle, rain, or snow. Moonrise surveys **cannot** be conducted when wind is a 3 or higher on the Beaufort Scale and during drizzle, rain, snow, or any conditions (such as cloud or fog) which would obscure the moon for more than 3 stops.

Wind: Record the rough wind speed at each stop using the Beaufort codes below. Do not begin a survey if wind is a 3 or above on the Beaufort Scale. If wind intensifies during the survey, and winds of a Gentle Breeze (3) or above persist for more than three stops, end the survey and attempt it again under better conditions.

Beaufort Number	Wind Speed	Description	Description
0	<0	Calm	Smoke rises vertically
1	1-3	Light Air	Wind motion visible in smoke
2	4-7	Light Breeze	Wind felt on exposed skin; leaves rustle
3	8-12	Gentle Breeze	Leaves and smaller twigs in constant motion; light flags extended – do not survey
4	13-18	Moderate Breeze	Dust and loose paper raised; small branches begin to move – do not survey
5	19-24	Fresh Breeze	Branches of moderate size move; small trees begin to sway - do not survey



Sky Condition: Record the sky condition at each stop using the codes below. Do not begin a moonrise survey if the sky is completely overcast. Do not conduct a sunset or moonrise survey if there is heavy fog or there is persistent snow, rain, or drizzle. If cloud cover intensifies during the moonrise survey, and the moon is fully obscured for more than three stops, end the survey and attempt it again under better conditions.

Code	Sky Condition	
0	Clear	Conduct survey
1	Partly Cloudy	Conduct survey only if moon is visible
2	Cloudy	Conduct survey only if moon is visible
3	Fog	Conduct survey only if moon is visible
4	Drizzle	Do not conduct survey
5	Snow	Do not conduct survey
6	Rain Showers	Do not conduct survey

Noise: Assign a noise code to each stop. Noise codes are a measure of the effect of noise on your ability to hear vocalizing birds. Although we have provided examples of noises for each code, these are meant only as general guidelines.

Code	Description
0	There is no appreciable effect on your ability to hear birds.
1	Noise slightly affects your ability to hear birds (e.g. distant traffic, dog barking, 1-2 car passing during survey period).
2	Noise moderately affects your ability to hear birds (e.g. nearby traffic, 3-6 cars passing during survey period, airplane flying overhead).
3	Noise seriously affects your ability to hear birds (e.g. continuous traffic nearby, construction noise, loud spring peeper chorus, more than 6 cars passing during the time spent at one point).

Cars: Record the number of cars that pass by during each of the entire count periods as a rough index of traffic noise. Counting cars is not the primary objective of the survey, however. Cap your car counting effort at 15 cars and record it on the data sheet as “15+”. Rather than counting a high number of cars, focus your energy on listening for what vocalizations you can discern through the traffic noise or breaks in traffic.

Point Start Time: Record the time you start your observations at each point.

Conducting Crepuscular and Nightjar Surveys:

While a single observer can conduct these surveys on their own, volunteers are welcome to bring a partner to assist with the survey efforts. **Only one volunteer should count and record the birds detected.** The other partner can act as the designated timekeeper and can announce the start of the survey and the break between the one-minute periods.

At each point, each observer will spend **six minutes** listening for nightjars and other vocalizing birds, with each bird's detections tracked across one-minute periods. What this means in practice is that you will have a single line on the survey form for each individual bird detected (see example on



the following page) and you will mark whether you detect it in each of the six one-minute periods. Additionally, we are asking that volunteers report the highest level of breeding behavior observed. Given that much of the survey effort will be completed near or after sunset, birds will likely be more often heard than seen. Consequently, “Singing Male” will often be the highest level detected. A more detailed explanation of breeding codes can be found in the appendix (Appendix C). Birds will sometimes move during the count, and you will need to use your best judgment when deciding if a “new” detection is actually an additional bird or simply an already-counted bird that has moved its location. Listening and recording data should be done from a safe, stationary point outside the car. **Do not** use whistling, playbacks, or any other method of coaxing birds to vocalize or move. Record birds detected during only the six-minute sample period, although you may record birds detected outside of this period in the “Comments” section of the form. Record birds as you hear them, rather than waiting for the sample period to be over, so as to avoid errors of omission.

Nightjars:

Eastern Whip-poor-will
Chuck-will's-widow
Common Nighthawk

Owls:

Eastern Screech Owl
Great Horned Owl
Barred Owl
Long-eared Owl
Short-eared Owl
Northern Saw-whet Owl

Other Nocturnal/Crepuscular species:

Common Loon
Black-crowned Night-heron
Yellow-crowned Night-heron
Yellow Rail
American Woodcock
Wilson's Snipe

Chimney Swift
Veery
Swainson's Thrush
Hermit Thrush
Wood Thrush
American Robin
Northern Mockingbird

While these birds are some of the most likely to be observed, this list is not exclusive and all observed species should be reported. If a bird that is not listed above is observed, write out the species name. Abbreviations are acceptable so long as they are easily recognized (i.e. “tree swal” for Tree Swallow). If no birds are detected on a point, enter the point number as usual, followed by “NONE” instead of a species code, and leave the columns for each time period blank (or draw a line through them). Doing so will reduce the possibility of becoming confused during a survey and forgetting which point you are on.

**Sample Data Form:**

Survey Point #	Species	Survey Minute						Moved?	Dir.	Breeding Code
		1	2	3	4	5	6			
1	Eastern Whip-poor-will	1	1	1	1	1	1		NE	S
1	Eastern Whip-poor-will	0	0	1	1	1	0		S	S
2	NONE									
3	Eastern Whip-poor-will	1	1	1	0	0	0		W	S
3	Eastern Whip-poor-will	0	0	0	1	1	1	x	SW	S
3	Common Nighthawk	0	0	0	0	1	0		SE	C
3	Eastern Whip-poor-will	0	0	0	0	1	1		N	S
4	Barred Owl	1	1	1	0	0	0		E	S
4	Eastern Whip-poor-will	0	0	0	1	1	1		SE	S
5	Etc.									

Example: In this form a “0” indicates that a given individual was NOT detected, while a “1” indicates it was. For example, at Point 1 an Eastern Whip-poor-will was heard in the first one-minute period and every period thereafter. A second Eastern Whip-poor-will was first detected in the third period and heard in the following two periods before becoming silent. No nightjars were heard at Point 2. At Point 3 an Eastern Whip-poor-will was heard during the first three periods, changed location, and continued to sing from that new location. Note that the “Moved?” column is used to document an individual changing position and resuming its vocalizations. It is not used to indicate that a bird is actively foraging or flying. A different Eastern Whip-poor-will was first detected in Period 4 and heard again in Periods 5 and 6. Because it did not overlap with the first bird, there is a possibility that they are the same bird and that it moved between Periods 3 and 4. Some cues that might suggest this are if calling ended early in Period 3 and started late in Period 4, but there is no hard and fast rule. Use your best judgment and be conservative about adding new individuals. Also at Point 3, both a Common Nighthawk and an Eastern Whip-poor-will were detected in Period 5, with the latter continuing into Period 6. The fact that this bird overlapped with the second Eastern Whip-poor-will is clear evidence that there are at least two of Eastern Whip-poor-wills at this point. At Point 4, a Barred Owl was heard in Periods 1-3 and an Eastern Whip-poor-will in Periods 2-6. This process would continue through Points 5-10. Remember that each bird has its own line. Do not record two birds calling from the same direction with a “2”.

Comments: Use this field to provide any additional information not included in the table. Examples of such data include:

- other nocturnal species detected outside the observation period.
- details on noise factors that might impede your ability to detect birds (use only if you used Noise Code 3 on a given point).
- any other information you wish to convey.
- if you need extra space, please feel free to write on the back of the forms.

**Equipment:**

- Data sheets and clipboard
- Survey protocol
- Route map and coordinates
- Flashlight and/or headlamp
- Stopwatch/timer
- Pens/pencils
- GPS

Safety:

Your safety comes first. Please ensure that you are conscious of your safety when conducting a survey. Please take the follow points into consideration:

- Consider conducting surveys in a team of two (with only one team member making observations).
- If surveying alone, make sure someone knows where your survey route is and what time you will return.
- Park your vehicle well off the road during survey stops.
- Leave parking lights on throughout the duration of a count.
- Wear a reflective vest and/or use a headlamp so that other drivers are aware of your location.
- Conduct the survey near the road to avoid trespassing on private property.
- Check your clothing and skin for ticks when you get home to prevent the transmission of Lyme disease and other tick-borne illnesses.

Questions?

Please contact Special Species and Habitat Technician, Logan Parker, for assistance.
logan@hereinthewild.com - (207) 649-4689



Survey Route Description Form

Route Name: _____ **Year:** _____

This form has three purposes:

- Record specific information on the observer assigned to a specific nightjar route
- Provide a space where observers can record details about each point location during a non-survey visit to the route. These will have been provided to you if the route has been conducted and described previously.
- Allow for recording of habitat information at each stop along a route.

Part 1: Observer Information

	Observer #1
Name	
Address	
City, State, Zip	
Phone Number	
Email Address	

Parts 2 and 3: Route Information

Point	Location Description (visible within 100 meters of point)	# build- ings visible	Dominant 3 hab- itats (see below)
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Habitat Codes:

A. Developed
B. Cultivated Land
C. Grassland/low herbs
D. Upland Forest - Deciduous
E. Upland Forest - Evergreen

F. Upland Forest - Mixed
G. Upland Scrub/shrub
H. Wetland - Forested
I. Wetland - Non-forested
J. Bare Land

K. Open Water
L. Alpine/subalpine

Wind Codes	Sky Codes	Noise Codes
0 Calm (<1 mph)	0 Clear	0 None
1 Light air (1-3 mph)	1 Partly Cloudy	1 Slight
2 Light breeze (4-7 mph)	2 Cloudy	2 Medium
3 Gentle breeze (8-13 mph)	3 Fog	3 Excessive
4 Moderate breeze (13-18 mph)	4 Drizzle	
5 Fresh breeze (19-24 mph)	5 Snow	
<i>If sustained 5, end survey</i>	6 Rain showers	

Date: _____

Start Time: _____

End Time: _____

[illegible][illegible]

Comments:

Return to:
Logan Parker (Special Species and Habitat Technician)
316 Chisholm Pond Rd, Palermo, ME 04354
logan@hereinthewild.com - (207) 649-4689





Date: _____

Start Time: _____ End Time: _____

[illegible]

Comments:

Return to:

Logan Parker (Special Species and Habitat Technician)
316 Chisholm Pond Rd, Palermo, ME 04354
logan@hereinthewild.com - (207) 313-9101

[illegible]



Appendix A. 2019 Solar and Lunar Calendar

Window	DATE	MOONRISE	MOONSET	SUNRISE	SUNSET
1st Lunar Cycle	May 15	4:15 PM	3:49 AM	5:12 AM	7:59 PM
	May 16	5:28 PM	4:17 AM	5:11 AM	8:00 PM
	May 17	6:40 PM	4:46 AM	5:10 AM	8:01 PM
	May 18	7:51 PM	5:18 AM	5:09 AM	8:02 PM
	May 19	8:59 PM	5:53 AM	5:08 AM	8:03 PM
	May 20	10:03 PM	6:32 AM	5:07 AM	8:04 PM
	May 21	10:59 PM	7:18 AM	5:06 AM	8:05 PM
	May 22	11:49 PM	8:08 AM	5:05 AM	8:06 PM
	May 23		9:04 AM	5:04 AM	8:07 PM
	May 24	12:31 AM	10:02 AM	5:03 AM	8:08 PM
	May 25	1:06 AM	11:02 AM	5:02 AM	8:09 PM
	May 26	1:37 AM	12:02 PM	5:01 AM	8:10 PM

Window	DATE	MOONRISE	MOONSET	SUNRISE	SUNSET
2nd Lunar Cycle	June 10	12:51 PM	1:25 AM	4:54 AM	8:22 PM
	June 11	2:04 PM	1:54 AM	4:54 AM	8:23 PM
	June 12	3:15 PM	2:21 AM	4:54 AM	8:23 PM
	June 13	4:26 PM	2:49 AM	4:54 AM	8:23 PM
	June 14	5:36 PM	3:18 AM	4:54 AM	8:24 PM
	June 15	6:44 PM	3:51 AM	4:54 AM	8:24 PM
	June 16	7:49 PM	4:28 AM	4:54 AM	8:25 PM
	June 17	8:49 PM	5:10 AM	4:54 AM	8:25 PM
	June 18	9:42 PM	5:58 AM	4:54 AM	8:25 PM
	June 19	10:27 PM	6:52 AM	4:54 AM	8:26 PM
	June 20	11:05 PM	7:49 AM	4:54 AM	8:26 PM
	June 21	11:38 PM	8:49 AM	4:55 AM	8:26 PM
	June 22		9:49 AM	4:55 AM	8:26 PM
	June 23	12:06 AM	10:50 AM	4:55 AM	8:27 PM
	June 24	12:32 AM	11:50 AM	4:55 AM	8:27 PM
	June 25	12:56 AM	12:51 PM	4:56 AM	8:27 PM

Window	DATE	MOONRISE	MOONSET	SUNRISE	SUNSET
3rd Lunar Cycle Northern Maine only	July 9	1:06 PM	12:26 AM	5:04 AM	8:24 PM
	July 10	2:17 PM	12:53 AM	5:04 AM	8:23 PM



Appendix B. Landcover/Habitats to be recorded visible within 100 m from point.

Macro-Habitat	Micro-Habitat	Description
Developed (mix of impervious surfaces and managed lawn grasses)	Commercial-in-industrial (>80% impervious)	Developed areas where people reside or work in high number. Examples include apartment complexes, row houses, commercial-industrial areas, and associated parking. Impervious surfaces account for more than 80% of total cover.
	High intensity (50-80% impervious)	Includes highly developed areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 50 to 80 percent of total cover.
	Medium intensity (20-50% impervious)	Includes moderately developed areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 20 to 50 percent of total cover.
	Low intensity (<20% impervious)	Includes sparsely developed areas with a mixture of constructed materials and vegetation. Impervious surfaces account for less than 20 percent of total cover.
Cultivated Land (actively managed lands for production of crops, pasture, hay)	Cultivated row crops	Land used for the production of crops, including annual-cycle crops (corn, potatoes, small grains, oilseed crops, vegetables, flowers, etc.). Plant cover is variable depending on season and type of farming and includes all land being actively tilled.
	Pasture-hay (actively managed)	These agriculture lands typically have perennial herbaceous cover (usually in recognizable fields) used for livestock grazing or the production of hay. There are obvious signs of management such as fencing and/or haying that distinguish them from natural grasslands.
	Blueberry barren	Composed of agricultural fields dominated by the production of low-bush blueberries. Multiple structural forms include: burned field, pruned field, early season with leaves, and late season with leaves and fruit set. This type is most common in eastern Maine.
	Orchard, Christmas tree plantation	Land used for orchards, vineyards, nurseries, and Christmas tree farms. Plant cover is variable depending on season and type of farming.
Grassland/Low Herbs (grasses generally >80%, without evidence of recent pasture/haying)	Unmanaged upland grassland	Upland areas with dense grasses (grasses >80% of vegetation cover) and occasionally sparse trees or shrubs. These areas are not subject to intensive management such as tilling, but might be used for grazing or hay production but there are no obvious or recent signs of fencing and haying. Characteristic land cover features: Prairies, dry meadows, fallow fields, and undeveloped lands with naturally occurring grasses.
	Coastal grasslands/dunes	Grasslands along marine coast or shores of large lakes (trees and shrubs sometimes present but subordinate to shrub/grass cover), e.g., dunes, sandy areas with sparse vegetation and small patches of shrubs.
	Rocky outcrop grassland/glade	Upland areas associated with rock outcrops, low elevation ridges and summits with a mixture of grasses and low herbs.
Upland Forest-Deciduous (trees usually >5m tall and forest >75% deciduous)	Oak-pine dominant	Oak dominated with subdominant pitch pine, red pine, white pine, or gray birch, dense to open woodlands with a low shrub or grass layer, or with sparse cover on dry rocky hilltops and outcrops. Overall trees greater than 5m tall and greater than 75% deciduous.
	Red oak- northern hardwoods dominant	A closed canopy forest of low to moderate moisture in which a significant component of red oak is present along with the normal suite of northern hardwoods, primarily sugar maple, beech, and yellow birch. Red maple, hemlock, and white pine are common associates. Overall trees greater than 5m tall and greater than 75% deciduous.
	Birch-beech-maple dominant	Northern hardwoods such as sugar maple, yellow birch, and beech are characteristic, either forming a deciduous canopy or mixed with red oak or hemlock (or in some cases white pine). Overall trees greater than 5m tall and greater than 75% deciduous.
	Trees <5 m tall, regen from cut, blowdown, fire	Use for an even-aged regenerating forest, recovering from previous disturbance such as a cut, significant blowdown, fire, etc. Overall trees less than 5 m tall and regenerating trees greater than 75% deciduous.
Upland Forest-Evergreen (trees usually >5m tall and forest >75% evergreen)	Pine-oak dominant	Pitch pine, red pine, or white pine dominated with subdominant oak or gray birch, dense to open woodlands with a low shrub or grass layer, or with sparse cover on dry rocky hilltops and outcrops. Overall trees greater than 5m tall and greater than 75% evergreen.
	Pine-hemlock dominant with red oak	White pine, hemlock are typical canopy dominants. Red maple and red oak can be subdominant. Overall trees greater than 5m tall and greater than 75% evergreen.
	Montane (>2,000 feet) spruce-fir dominant)	A high elevation (>2,000 feet) conifer forest dominated by red spruce and balsam fir. Heartleaved birch is a characteristic tree along with yellow birch, white birch, mountain maple, striped maple, mountains ash, and occasionally black spruce at upper patch edges. Dense beds of sphagnum moss cover much of the forest floor, and lichens hang from the trees.
	Low-elevation (<2,000 feet) spruce-fir dominant	A low elevation (<2,000 feet) conifer forest dominated by red spruce and balsam fir. Black and white spruce are sometimes present, along with yellow birch, paper birch, beech, and red or sugar maple, and northern white cedar in moist locations. Bryophytes are dominant in a dense herb layer. In successional patches, paper birch, aspen, and larch are mixed in with the spruce and fir.
	Spruce flat and jack pine-spruce dominant	Soils are nutrient-poor and loamy to sandy, varying from thin soil over bedrock to deeper soils. Jack pine or black spruce is the characteristic over-story tree, occurring with other spruce species and/or red pine. White birch and aspen may also be present. Dwarf heath shrubs can be extensive. Overall trees greater than 5m tall and greater than 75% evergreen.
	Trees <5 m tall, regen from cut, blowdown, fire	Use for an even-aged regenerating forest, recovering from previous disturbance such as a cut, significant blowdown, fire, etc. Overall trees less than 5 m tall and regenerating trees greater than 75% evergreen.



Macro-Habitat	Micro-Habitat	Description
Upland Forest-Mixed (trees usually >5m tall and forest <75% deciduous or evergreen)	Oak/pine	Mix of oak, pitch pine, red pine, white pine, or gray birch, dense to open woodlands with a low shrub or grass layer, or with sparse cover on dry rocky hilltops and outcrops. Overall trees greater than 5m tall and less than 75% deciduous and less than 75% evergreen.
	Birch-beech-maple/pine-hemlock	Northern hardwoods such as sugar maple, yellow birch, and beech are characteristic, either forming a deciduous canopy or mixed with red oak or hemlock (or in some cases white pine). Overall trees greater than 5m tall and less than 75% deciduous and less than 75% evergreen.
	Pine-hemlock/hardwoods	Mix of white pine, hemlock red maple, and red oak. Overall trees greater than 5m tall and less than 75% deciduous and less than 75% evergreen.
	Spruce-fir/hardwoods	Forests with a mix of red spruce, balsam fir, black and white spruce, yellow birch, paper birch, beech, and red or sugar maple. The soils are usually rocky, mostly well- to moderately well-drained but with some somewhat poorly drained patches at the slope bottoms. Overall trees greater than 5m tall and less than 75% deciduous and less than 75% evergreen.
	Trees <5 m tall, regen from cut, blowdown, fire	Use for an even-aged regenerating forest, recovering from previous disturbance such as a cut, significant blowdown, fire, etc. Overall trees less than 5 m tall and regenerating trees less than 75% deciduous and less than 75% evergreen.
Upland Scrub/Shrub (shrubs and early successional or environmentally stunted trees <5m tall)	Old field (formerly cleared, early successional)	Herb-shrub vegetation resulting from succession following virtually complete removal of native woody cover of an area, primarily on lands cleared for agriculture or pasture. Grasses minor component of vegetation cover. Lands may have been cleared decades ago or more recently. Shrubs and early successional or environmentally stunted trees <5m tall.
	River & lakeshore shrubland	Non-wetland open shores bordering lakes, rivers, and streams; substrate rocky or sandy, vegetation shrub dominated. Shrubs and early successional or environmentally stunted trees <5m tall.
	Powerline right-of-way	Shrub-dominated, sometimes with areas of herb-dominated vegetation, maintained under powerline rights-of-way. Shrubs and early successional or environmentally stunted trees <5m tall.
	Introduced shrubs (honeysuckle, barberry)	These shrublands are dominated by aggressive exotic species including honeysuckles, multiflora rose, barberry, privet, and others. They are primarily upland but can occur in seasonally wet situations, and typically develop on disturbed former fields where soil structure and/or chemistry have been altered. Shrubs and early successional or environmentally stunted trees <5m tall.
	Outcrop & summit shrub	Upland areas with a mixture of shrubs, herbs, and sometimes stunted trees, associated with rock outcrops and summits. Shrubs and early successional or environmentally stunted trees <5m tall.
Wetland-Forested (wetlands without trees or trees >5m tall and canopy cover >20%)	Floodplain hardwoods	Floodplains of rivers and streams where the stream gradient is low. Associated vegetation includes silver maple, Green ash, American elm, red maple, sugar maple, balsam poplar, red oak, and musclewood. The herb layer includes abundant spring ephemerals, often giving way to fern dominance by mid-summer. Wetlands with trees >5m tall and canopy cover >20%.
	Red maple, spruce, fir, ash swamp	Wooded, non-floodplain wetlands, wet or saturated for the growing season, usually dominated by red maple, spruce, fir, and ash. Wetlands with trees >5m tall and canopy cover >20%.
	Cedar swamp	Wooded wetlands, characterized by cedar or pitch pine. Wetlands with trees >5m tall and canopy cover >20%.
Wetland-Non-forested (wetlands with trees <5m tall and canopy cover <20%)	Emergent marsh (freshwater)	Freshwater marshes with more-or-less permanent water and with non-persistent vegetation. Wetlands without trees or trees <5m tall and canopy cover <20%.
	Modified marsh (beaver/human impoundments)	Freshwater wetlands dominated by non-native species, and marshes created by human-made or beaver-made impoundments in areas that would not otherwise be marshes. Wetlands without trees or trees <5m tall and canopy cover <20%.
	Wet meadow (freshwater)	Freshwater marshes and wet meadows with persistent vegetation of shrubs, sedges, and wetland forbs. Wetlands without trees or trees <5m tall and canopy cover <20%.
	Peatland (freshwater)	Bogs and fens, the substrate dominated by Sphagnum peat, usually without trees or with few trees. Any woody vegetation less than 5 meters in height and tree canopy coverage is less than 20 percent.
	Coastal salt marsh (saltwater or brackish)	Salt marshes along immediate ocean shore and near estuary mouths. These marshes are dominated by grasses with patchy herbs. Any woody vegetation less than 5 meters in height and tree canopy coverage is less than 20 percent.
Bare Land (bare ground with vegetation <10% ground cover)	Cliff & talus	Vertical or near-vertical cliffs and the talus slopes associated with them (and the occasional talus areas developing without adjacent cliffs). Bare ground with vegetation <10% ground cover.
	Exposed rock outcrops/low elevation summits	Upland areas with a mixture of sparse vegetation, associated with rock outcrops and summits. Bare ground with vegetation <10% ground cover.
	Gravel pits, quarries	Surface mining operations for various materials: sand, gravel, rock, etc. Bare ground with vegetation <10% ground cover.
	Rocky coast	Sparsely vegetated and maritime-influenced rocky areas along the coast. Bare ground with vegetation <10% ground cover.
Open Water (>75% water)	Open water	Water with greater than 75% cover over the area.
Alpine/subalpine (near or above treeline)	Krummholz forest	Dwarf, twisted, stunted spruce and fir trees near treeline, mostly above 3,000 feet in elevation (slightly lower near the exposed coastal mountains).
	Above treeline (tundra, dwarf shrubs, veg)	Includes vegetation above treeline on mountains. Most of the cover is dwarf-shrubland, lichen, or sparse vegetation; islands of taller shrubs may occur in protected spots. The dominant plants are dwarf heaths (bilberry is diagnostic and often dominant) and Diapensia. This system includes wetland depressions, such as small alpine bogs, within the surrounding upland matrix.

**Appendix C. Breeding Codes**

CONFIRMED	
NY	Nest with young
NE	Nest with eggs
FS	Carrying fecal sac
FY	Feeding young
CF	Carrying food
FL	Recently edged young
ON	Occupied nest
UN	Previously used nest (use with caution)
DD	Distraction display
NB	Nest building (except woodpeckers & wrens)
CN	Carrying nesting material
PE	Physiological evidence, brood patch
PROBABLE	
B	Woodpecker / wren nest building, cavity excavation
A	Agitated behavior
N	Visiting probable nest site
C	Courtship display, copulation
T	Territory defense
P	Pair in suitable habitat
M	Multiple (7+) singing birds
S7	Singing birds heard 7+ days apart
POSSIBLE	
S	Singing birds
H	Observed in appropriate breeding habitat