Whip-poor-will and Common Nighthawk Surveys
In Support of the Michigan Breeding Bird Atlas II

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EXECUTIVE SUMMARY

In 2004, the Michigan Natural Features Inventory proposed a three-year statewide survey of Whip-poor-wills (*Caprimulgus vociferus*) and Common Nighthawks (*Chordeiles minor*) to increase the data available for the Michigan Breeding Bird Atlas II (MBBA II) Project. Fifteen (15) randomly selected North American Breeding Bird Survey (BBS) routes in the eastern third of the state were surveyed in 2005 from mid-May to the end of June. Ten randomly selected point count stations were situated at 1.6-km (1.0-mi) intervals within each route. Surveys began exactly at sunset and continued for a minimum of 2-hrs. Surveys during high winds or rain were avoided. Environmental variables recorded were wind speed, temperature, noise level, precipitation, and moon phase. We also recorded land cover type and noted general tree heights in recent clear cut areas. Each station consisted of one-min silent period followed by a two-min broadcast for each species. The broadcasts contained two series of calls for each species, and the series and calls were separated by 30-sec silent periods. The calls were broadcasted using an electronic game caller. The period of first response and estimated location for each bird was recorded. The data recorded at survey points were summarized by quarter-township (9 mi²) MBBAII survey blocks. To determine trends in habitat use, survey stations were characterized by cover type using the following classifications: pine barren (open canopy), pine barren (closed canopy), mixed hardwood/conifer forest, conifer swamp, stream/riparian, hardwood forest, residential – mixed habitat, shrub wetland, tilled agricultural, emergent marsh, conifer forest, old field, pine plantation (clear-cut), pine plantation (trees < 1 m), pine plantation (trees 1-3m), pine plantation (trees > 3 m), and hardwood clear cut.

In addition to the route surveys, information was collected on the calling behavior of the two species with a primary focus on Whip-poor-wills. Overnight listening surveys were conducted once a week at specific points to determine the frequency of calling in relation to time period and moon phase. The number of birds calling and the intensity of calling was recorded every 15-min from approximately 2200 hrs until sunrise. We noted the wind speed, temperature, cloud cover, and moon phase for each 15-min period. Locations of birds were recorded using estimated distance and orientation.

We heard 81 Whip-poor-wills and 70 Common Nighthawks during the route surveys. Neither species was recorded along the southern Lower Peninsula (SLP) routes. The highest observation rates for both species occurred during the second period in the northern Lower Peninsula (NLP). We assigned breeding status for Whip-poor-wills and Common Nighthawks in 70 MBBA II survey blocks.
Preliminary comparisons of the number of responses observed during equal length time periods occurring before and after broadcasts indicated that response to calls by either species did not increase after broadcasts.

We recorded both species most often in upland coniferous forests and pine plantations. Whip-poor-wills were not observed in riparian areas or hardwood forests; nighthawks were not recorded in conifer swamps or mixed residential areas. Neither species were observed in agricultural areas. Both species utilized recently harvested forests and were found in equal numbers in areas with trees 1-3 m and greater than 3m. Additional data and analysis are needed to better understand habitat preference for these species.

Calling behavior was monitored to determine the best survey times for both species. The average calling intensity and number of birds calling over time for both species was higher during the full moon than the quarter moon. We compared the times when both species began and ended calling with sunrise, sunset, and civil twilight. On average Whip-poor-wills appeared to end their calling 8.5 min after the beginning of civil twilight and 27.75 min before sunset. No trends could be detected for when calling began as there was too much variability in the data. There were few data available for Common Nighthawks, but there were potential trends during quarter moon phases. Common Nighthawks began calling 6-7 hr after the end of civil twilight and approximately 6.5-7.5 hr after sunset. Calling ended 8-26 min before the beginning of civil twilight and 29-63 min before sunrise.

We believe additional Whip-poor-will and Common Nighthawk surveys are needed to increase coverage for Atlas purposes, refine the survey protocols, and better understand their distribution, phenology, and habitat use. Research is also needed to determine the effects of pesticide use and forest fragmentation and management on both species.

INTRODUCTION

Whip-poor-wills (Caprimulgus vociferus) and Common Nighthawks (Chordeiles minor) are members of the Caprimulgidae family (goatsuckers). Both species are believed to be declining range wide due to habitat loss and/or degradation and possible food shortages attributed to pesticide use (Eastman 1991a, 1991b).

In 2004, the Michigan Natural Features Inventory (MNFI) proposed to conduct systematic surveys for Whip-poor-wills and Common Nighthawks to contribute information to the Michigan Breeding Bird Atlas II (MBBA II) Project. The MBBA II is a six-year project that began in 2002 to re-map the distribution of breeding birds in the State (Kalamazoo Nature Center 2005 Whip-poor-will and Common Nighthawk Survey 2
Crepuscular species such as Whip-poor-wills and Common Nighthawks are often underrepresented in large-scale breeding bird surveys, such as state atlas projects and the North American Breeding Bird Survey (BBS). This is largely due to the difficulty of data collection. We expected a three-year effort would be required to adequately survey the state for these species. The objectives of this study were to obtain information on the distribution, abundance, breeding status, habitat use, and phenology of Whip-poor-wills and Common Nighthawks. Additionally, we aimed to gather information on the efficacy of broadcast call survey techniques. This report presents the results of the first of a three-year study.

METHODS

Routes and Points Selection

Routes established by the North American Breeding Bird Survey (BBS) were utilized for this study. We divided the State into three zones: southern-lower peninsula (SLP), northern-lower peninsula (NLP), and upper-peninsula (UP), and these were further divided into three study areas per zone (Figure 1). Study areas were designated by dividing each zone approximately into thirds. Five routes were randomly selected in each study area. Due to the limited amount of survey time each evening, 10 consecutive points at 1.6-km (1-mi) intervals per route were selected for censusing, beginning with a randomly selected starting point. If a point was skipped due to accessibility or safety issues, the survey resumed at the next acceptable point.

Time of Year

Surveys for both species (combined in this study) began in the SLP and continued for one week before moving northward to the next region. Each region was surveyed for a period of one week following the northward seasonal change. All routes were surveyed twice beginning with the SLP and ending with the UP. Surveys were conducted from 15 May – 24 June.

Time of Day

Whip-poor-wills and Common Nighthawks forage primarily in the crepuscular hours (dawn and dusk) (Schinkle 1994a, Schinkle 1994b). Standard (non-calling behavior) censusing began at sunset and continued for no more than 2-hrs after sunset.
Figure 1. Location of 2005 nocturnal bird survey routes conducted in Michigan.
Weather

Surveys were not conducted during the following weather conditions: 1) wind speeds greater than 8-km/hr, 2) ambient temperature below 7°C (44.6°F), and 3) heavy precipitation (British Columbia Ministry of Environment, 1998).

Point Counts

Point count surveys were started exactly at sunset. Electronic game callers were used to broadcast calls for the target species. After a one minute silent listening (SL) period following arrival, calls of each species were broadcast as follows:

30-sec of calls (species 1) – 30-sec silence
30-sec of calls (species 1) – 30-sec silence
30-sec of calls (species 2) – 30-sec silence
30-sec of calls (species 2) – 30-sec silence

We used random numbers to select the species (Whip-poor-will or Common Nighthawk) to broadcast first. The following environmental variables were recorded: wind speed, temperature, noise level, precipitation, and moon phase. The period of first response and estimated location for each bird was recorded. The data recorded at survey points were summarized by quarter-township (9-mi²) MBBA II survey block. Incidental bird species were also recorded.

Calling Behavior

One of the objectives of this study was to examine the calling behavior of Whip-poor-wills and Common Nighthawks in Michigan using the focal-animal approach. One, all-night survey was conducted each week and was based on the phase of the moon (full, quarter). If a calling bird was detected during a route, we determined the suitability of that point for conducting all-night observations. Factors considered were the amount of traffic present and surveyor safety. If a point was determined to be satisfactory, we finished the route and then returned to that point to conduct calling observations. Calling behavior observations then continued every 15-min until sunrise. We recorded the time and intensity of all calling for each 15 minute period. We used four ranks to characterize the frequency of calling in each 15-min period: 0=none, 1=sporadic, 2=intermittent, 3=frequent, and 4=continuous. Sporadic calling was defined as infrequent calling, intermittent as calling broken by a short time interval, and frequent as calling throughout most of the time period but not continuously. Booming nighthawks were also noted. We
recorded the cloud cover, precipitation, temperature, wind speed, and moon phase for each 15-min period. Times for sunset, sunrise, and the beginning and ending of civil twilight were obtained from the U.S. Naval Observatory, Astronomical Applications Department. The compass bearing of each calling bird was also recorded.

**Atlas Breeding Status**

Breeding status was determined by survey block using methods outlined in the MBBA II Project Handbook (Kalamazoo Nature Center 2004). The survey blocks are based on quarter-townships and consist of nine legal sections. Whip-poor-wills and Common Nighthawks that vocalized in response to broadcast calls or were heard vocalizing prior to broadcast calls were treated as singing males and assigned the appropriate breeding criteria codes.

**Habitat**

To examine trends in habitat use, the landscape surrounding the survey points was characterized by using the following classifications: pine barren, conifer swamp, stream/riparian habitat, shrub wetland, tilled agricultural, emergent marsh, conifer forest, old field, pine plantation (clear-cut), pine plantation (trees < 1 m), pine plantation (trees 1-3m), pine plantation (trees > 3 m), and hardwood clear cut.

**Data Analysis**

We used the Sign Test to determine if the number of Whip-poor-will and nighthawk observations recorded before and after conspecific broadcasts was significantly different than what would be expected. Binomial distribution was assumed since only the presence or absence of a species before or after a broadcast was considered. The Sign Test is a nonparametric paired-sample test developed from the concept of the binomial test, and is essentially a binomial test with p hypothesized to be 0.50 (Zar 1996). We only used data from stations where Whip-poor-wills and Common Nighthawks were heard before (+) or after (-) conspecific calls were played. Testing was conducted by survey period, since responsiveness may vary due to breeding phenology.
RESULTS

Atlas Breeding Status

We heard 81 Whip-poor-wills and 70 Common Nighthawks during surveys conducted at 131 points along fifteen survey routes (Table 1). Neither species was recorded along the southern Lower Peninsula (SLP) routes and observation rates were similar for the two species. The highest observation rates for both species occurred during the second period in the northern Lower Peninsula (NLP). Observation rates in the UP were higher during the first survey period (mid-May – early June) (Table 1).

We documented breeding activity for the two species on 70 MBBA II survey blocks (Table 2) (Figures 2 and 3). The highest number of blocks with Whip-poor-will and Common Nighthawk breeding records was documented in the UP (45), with 25 LP and no SLP blocks having observations. Table A-1 (Appendix A) lists the breeding data by survey block and Table A-2 provides two incidental reports by survey block.

We observed breeding activity of five incidental species during the surveys (Table 3), including the State Special Concern Species American Bittern (*Botaurus lentiginosus*). Barred Owl (*Strix varia*) and American Woodcock (*Scolopax minor*) were the most commonly observed incidental species, recorded from 5 survey blocks each. Great Horned Owls (*Bubo virginianus*) and Sandhill Cranes (*Grus canadensis*) were observed in only a single block each (Table A-3). Incidental species data are summarized by survey block in Table A-3 (Appendix A).

Landscape-level Habitat

We observed both species most often in coniferous forests and pine plantations (Figure 4). Whip-poor-wills were not observed in riparian areas or hardwood forests, and Common Nighthawks were not recorded in conifer swamps or mixed residential areas. Neither species was observed in agricultural areas. We also examined the use of recently harvested forests in various stages of regrowth. Both Whip-poor-wills and Common Nighthawks were recorded in greater numbers in clear cut areas than in clearings with trees greater than 1 m tall (Figure 5).
Table 1. Summary of Whip-poor-will and Common Nighthawk observations by region and survey period recorded during surveys conducted in Michigan in 2005.

<table>
<thead>
<tr>
<th>Regiona</th>
<th>Survey No.</th>
<th>Period</th>
<th>Points</th>
<th>No. Whip-poor-wills</th>
<th>No. Nighthawks</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>No. Obs.b</td>
<td>Meanc</td>
<td>No. Obs.</td>
</tr>
<tr>
<td>SLP</td>
<td>1</td>
<td>33</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>36</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<td>Subtotal</td>
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<td>NLP</td>
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<tr>
<td></td>
<td>2</td>
<td>42</td>
<td>31</td>
<td>0.74</td>
<td>29</td>
<td>0.67</td>
</tr>
<tr>
<td></td>
<td>Subtotal</td>
<td>92</td>
<td>42</td>
<td>0.46</td>
<td>35</td>
<td>0.38</td>
</tr>
<tr>
<td>UP</td>
<td>1</td>
<td>45</td>
<td>21</td>
<td>0.47</td>
<td>21</td>
<td>0.47</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>51</td>
<td>18</td>
<td>0.35</td>
<td>14</td>
<td>0.27</td>
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<td></td>
<td>Subtotal</td>
<td>96</td>
<td>39</td>
<td>0.41</td>
<td>35</td>
<td>0.36</td>
</tr>
<tr>
<td>Overall</td>
<td>1</td>
<td>128</td>
<td>32</td>
<td>0.25</td>
<td>27</td>
<td>0.21</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>129</td>
<td>49</td>
<td>0.38</td>
<td>43</td>
<td>0.33</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>258</td>
<td>81</td>
<td>0.31</td>
<td>70</td>
<td>0.27</td>
</tr>
</tbody>
</table>

aSLP = Southern Lower Peninsula, NLP = Northern Lower Peninsula, UP = Upper Peninsula.
bNumber of birds observed.
cAverage Number of birds per point surveyed.
Table 2. Number of blocks with Whip-poor-will and Common Nighthawk observations by region from surveys conducted in Michigan in 2005.

<table>
<thead>
<tr>
<th>Species</th>
<th>SLP</th>
<th>NLP</th>
<th>UP</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whip-poor-will</td>
<td>0</td>
<td>11</td>
<td>25</td>
<td>36</td>
</tr>
<tr>
<td>Common Nighthawk</td>
<td>0</td>
<td>14</td>
<td>20</td>
<td>34</td>
</tr>
<tr>
<td>Total</td>
<td>0</td>
<td>25</td>
<td>45</td>
<td>70</td>
</tr>
</tbody>
</table>

Figure 2. MBBA II survey blocks with Common Nighthawk observations during surveys conducted in Michigan during 2005.
Figure 3. MBBA II survey blocks with Whip-poor-will observations during surveys conducted in Michigan during 2005.

Table 3. Number of blocks with incidental species observations by region from Whip-poor-will and Common Nighthawk surveys in Michigan in 2005.

<table>
<thead>
<tr>
<th>Species</th>
<th>SLP</th>
<th>NLP</th>
<th>UP</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Great Horned Owl</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Sandhill Crane</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>American Woodcock</td>
<td>0</td>
<td>4</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Barred Owl</td>
<td>0</td>
<td>5</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Common Loon</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>American Bittern</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>1</td>
<td>11</td>
<td>2</td>
<td>14</td>
</tr>
</tbody>
</table>

2005 Whip-poor-will and Common Nighthawk Survey 10
Figure 4. Whip-poor-will and Common Nighthawk observations by habitat type as determined from surveys conducted in Michigan during 2005.

Figure 5. Whip-poor-will and Common Nighthawk observations by tree height in managed pine forests as determined from surveys conducted in Michigan during 2005.
Survey Efficacy

Our results indicated that for both species the number of responses before and after broadcasts did not significantly differ. Most Whip-poor-wills and Common Nighthawks were heard calling immediately upon exiting our vehicles. Whip-poor-wills that were heard calling from distances greater than 0.25 km often moved closer after broadcasts, but that depended on whether other Whip-poor-wills were calling between their locations and the broadcast points.

Calling Behavior

Four overnight surveys were conducted to document the calling intensity of Whip-poor-wills and Common Nighthawks (if present). Surveys were conducted on 24 May, 30 May, 14 June, and 22 June from at least 2400 hr until sunrise. Half the dates were during quarter moon and half were during full moon phases. No data were collected during the new moon phase because there were no birds observed on the designated routes.

The average Whip-poor-will calling intensity over time was higher and for a longer duration during the full moon than the quarter moon phase (Figure 6). Calling intensity during the quarter moon phase peaked at 0500 hr and dropped sharply near sunrise. The average number of Whip-poor-wills calling over time during the full moon phase was also higher than the quarter moon phase (Figure 7). The number of birds calling during both moon phases increased between 0300 and 0400 hr and quickly declined approximately ½ hr before sunrise. The average calling intensities and number of calling Whip-poor-wills were highest during the full moon date of 24 May and lowest during the quarter moon date of 14 June (Table 4). Average calling intensity was higher overall during the full moon phase.

The average calling intensity over time for nighthawks during the full moon was fairly uniform at 2.0 (intermittent) beginning at 0100 hr, but the frequency of calling during the night was sporadic (Figure 8). Average calling intensities were low during the quarter moon phase until drastically increasing to the maximum value of 4 between the hours of 0345 and 0530 (Figure 9). The highest average calling intensities and average number of calling Common Nighthawks occurred during the full moon phase on 22 June (Table 5).
**Figure 6.** Average calling intensity of Whip-poor-wills by time as determined from calling surveys conducted in Michigan during 2005.

**Figure 7.** Average number of Whip-poor-wills calling by time during full and quarter moon phases as determined from calling surveys conducted in Michigan during 2005.
### Table 4. Average calling intensity and number of Whip-poor-wills calling during surveys conducted in Michigan in 2005.

<table>
<thead>
<tr>
<th>Date</th>
<th>Ave. Calling Intensity</th>
<th>Ave. No. Calling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full Moon</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24-May</td>
<td>3.40</td>
<td>1.81</td>
</tr>
<tr>
<td>22-Jun</td>
<td>3.17</td>
<td>0.88</td>
</tr>
<tr>
<td>Quarter Moon</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30-May</td>
<td>1.19</td>
<td>0.74</td>
</tr>
<tr>
<td>14-Jun</td>
<td>0.02</td>
<td>0.08</td>
</tr>
</tbody>
</table>

### Table 5. Average calling intensity and number of Common Nighthawks calling during surveys conducted in Michigan in 2005.

<table>
<thead>
<tr>
<th>Date</th>
<th>Ave. Calling Intensity</th>
<th>Ave. No. Calling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full Moon</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24-May</td>
<td>0.04</td>
<td>0.04</td>
</tr>
<tr>
<td>22-Jun</td>
<td>1.33</td>
<td>0.5</td>
</tr>
<tr>
<td>Quarter Moon</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30-May</td>
<td>0.67</td>
<td>0.33</td>
</tr>
<tr>
<td>14-Jun</td>
<td>0.38</td>
<td>0.13</td>
</tr>
</tbody>
</table>
Figure 8. Average calling intensity of Common Nighthawks by time as determined from calling surveys conducted in Michigan during 2005.

Figure 9. Average number of calling Common Nighthawks by time as determined from calling surveys conducted in Michigan during 2005.
We compared the times when both species began and ended calling with sunrise, sunset, and civil twilight. Whip-poor-wills appeared to end their calling on an average of 8.5 min after the beginning of civil twilight (SE=1.7, n=4), and 27.75 min before sunset (SE=1.25, n=4) (Table 6). No trends could be detected for the start time of calling because of too much variability in the data.

There were few data available for Common Nighthawks, but there were potential trends during quarter moon phases. Nighthawks began calling 6-7 hr after the end of civil twilight and approximately 6.5-7.5 hr after sunset (Table 7). Calling ended 8-26 min before the beginning of civil twilight and 29-63 min before sunrise.

DISCUSSION

Atlas Data

The results of this survey underscore the need for long-term studies in order to understand the habitat needs, distribution, and abundance of Whip-poor-wills and Common Nighthawks in Michigan. Due to the natural history of these species, surveys could only be conducted for a few hours each evening which limits the number of routes and surveys that can be covered during the breeding season. Additionally, Whip-poor-wills nest several weeks earlier than Common Nighthawks (Eastman 1991a, 1991b), which complicates the survey cycles.

If funding permits, additional crews may be used during future surveys. This would enable greater coverage of survey blocks (increasing coverage for the MBBA II), allow staggered surveys to ensure equal coverage for both species, and provide a better understanding of landscape use, breeding phenology, distribution, and abundance. Greater coverage from long-term studies may also allow the analysis of the affects of environmental and landscape level variables on Caprimulgid detectability and site occupancy.

<table>
<thead>
<tr>
<th>Date</th>
<th>Location</th>
<th>Moon Phase</th>
<th>Calling Began</th>
<th>Civil Twilight Ended</th>
<th>Difference</th>
<th>Calling Ended</th>
<th>Civil Twilight Began</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>24-May</td>
<td>Hillman, MI</td>
<td>Full</td>
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Landscape-level Habitat

Whip-poor-wills have been documented in a variety of habitat types across their range, primarily dry deciduous or mixed forests with little or no underbrush (Cink 2002). Habitat preference seems to vary regionally from broken pine (*Pinus*)-oak (*Quercus*) forests in Ontario to open and partially open pitch pine (*P. rigida*)-scrub oak (*Q. ilicifolia*) barrens on Cape Cod. In contrast to our surveys, Whip-poor-wills in the Sand Ridge Forest of Illinois were least abundant in Jack Pine plantations (Bjorklund and Bjorklund 1983). In Kentucky they were found in a variety of semi-open habitats including clearcuts, farmland, and open fields (Palmer-Ball 1996).

Rangewide, Nighthawk nesting habitat includes woodland clearings, farm fields, open forests, rock outcrops, logged or slashburned areas of forest sites, coastal dunes and beaches, and flat gravel rooftops of city buildings (Poulin et al. 1996).

Our preliminary observations from 15 routes in the eastern third of Michigan suggest that both species may prefer coniferous forests and pine plantations; State and Federal Forest lands managed for the endangered Kirtland’s Warbler (*Dendroica kirtlandii*) had the highest numbers of Whip-poor-wills and Common Nighthawks. These Jack Pine forests are harvested and planted (or left to naturally seed) on a rotating basis and appear to provide habitat for both species. Further surveys and habitat analysis will provide a better understanding of habitat preferences in Michigan.

Survey Efficacy and Calling Behavior

Point counts are the most commonly used survey method for Caprimulgidae species; however, existing survey protocols for Whip-poor-wills and nighthawks vary in terms of the use of broadcast calls. The Massachusetts Whip-poor-will Survey employs silent listening techniques (Massachusetts Natural Heritage Program, 2002); while in British Columbia broadcast calling is used (British Columbia Ministry of Environment, 1998). Based on preliminary results, the use of broadcast calls during surveys for Whip-poor-wills and Common Nighthawks do not appear necessary to locate calling birds. This finding could be beneficial for future survey efforts, as more points can be covered using the silent listening approach. Broadcasting may bring birds closer that have established territories some distance from the count points, but our findings suggest that this was seldom the case.

In the selection of future routes and points, we recommend avoiding locations that lack potential habitat (e.g. expansive agricultural areas with no forested cover). Major roadways that have high volumes of traffic (which significantly diminish the ability of surveyors to hear the birds), most often run through unsuitable habitat, and are of safety concern to the surveyors, should be
avoided. By optimizing the quality of routes and points, surveyors should obtain more Atlas data.

The nightly start and end times of this survey were derived from protocols in Massachusetts and British Columbia. Massachusetts Whip-poor-will surveys begin 15 min after sunset and end no later than 105 min after sunset (Massachusetts Natural Heritage Program, 2002). Common poorwill (Phalaenoptilus nuttallii) surveys begin at civil twilight (the point at which the sun is 6° below the horizon, or approximately ½ hr after sunset); Nighthawk surveys in British Columbia begin at dusk and continue until the end of the dusk crepuscular period (the time between sunset and nautical twilight) (British Columbia Ministry of Environment, 1998). We conducted calling behavior surveys to determine the best survey times for Whip-poor-wills and Common Nighthawks in Michigan. There were substantial differences in the number of birds calling and their intensity between quarter and full moon nights. This supports the results of Cooper (1981), who studied the correlation between moon phase and the calling behavior of Whip-poor-wills and Chuck-will’s widow (Caprimulgus carolinensis). He found that the birds called throughout the night during full moons and only during dusk and dawn the rest of the month. Our preliminary results indicate that both species have higher calling intensities and number of birds calling between 0400 hr and sunrise regardless of moon phase (Figures 6-9). Additional calling surveys in Michigan could help determine the most appropriate time of day for future surveys and provide important information on breeding phenology.

ACKNOWLEDGEMENTS

This project was funded by the Michigan Department of Natural Resources Wildlife Division through the State Wildlife Grants Program. Patrick Brown (MNFI) and Peter Pearman (MNFI) assisted with the study design and survey protocol. Katie Cottrell, Michael Sanders, and ShuNahSii Rose assisted with surveys. Dr. Catherine Bach and Neil Chartier (Eastern Michigan University) assisted with routes in the SLP. Administrative support was provided by Lyn Scrimger, Sue Ridge, and Connie Brinson. Helen Enander provided GIS technical advice. Mike Monfils assisted with study design and analysis.

LITERATURE CITED


APPENDIX A - MICHIGAN BREEDING BIRD ATLAS DATA
Table A-1. Whip-poor-will and Common Nighthawk observation data by MBBA II survey block from surveys conducted in Michigan in 2005.

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Species: CONI - Common Nighthawk; WPWI = Whip-poor-will

Owl observation ID = Species+Route+Station (suffix 2 = second visit, 22 = second visit and route variation)

Observers: BB = Barbara Barton; KC = Katie Cottrell; MS = Michael Sanders

Breeding criteria code: X = singing male present in suitable nesting habitat during its breeding season, C = courtship or mating observed.

Priority survey block: Y = yes and N = no.
Table A-2. Incidental Whip-poor-will observation data by MBBA II survey block from surveys conducted in Michigan in 2005.

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aSpecies: CONI - Common Nighthawk; WPWI = Whip-poor-will
bObservation ID = Species+Location+ID (SNWR = Seney National Wildlife Refuge)
cObservers: JG = Julie Gibson, GC = Greg Corace
dBreeding criteria codes X = singing male present in suitable nesting habitat during its breeding season.
ePriority survey block: Y = yes and N = no.
Table A-3. Incidental species observation data by MBBA II survey block from Whip-poor-will and Nighthawk surveys conducted in Michigan in 2005.

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Species: AMWO = American Woodcock, BADO = Barred Owl, GHOW = Great-horned Owl, COLO = Common Loon, AMBI = American Bittern, SACR = Sandhill Crane.

Observation ID = Species+Route+Station

Observers: BB = Barbara Barton; KC = Katie Cottrell; SR = ShuNahSii Rose.

Breeding criteria codes: X = singing male present in suitable nesting habitat during its breeding season.

Priority survey block: Y = yes and N = no.