Meadow Bird Monitoring Protocol

Terrestrial Long-term Monitoring Program

Regional Watershed Monitoring and Reporting

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Toronto and Region Conservation
for The Living City®

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1.0 INTRODUCTION

Birds, being present to varying degrees in all habitats and in all landscapes, provide a readily visible and therefore easily monitored fauna element. By stipulating a series of limitations on count range and duration along with other collection methods; a degree of standardization can be achieved that allows for consistency over the many years required to acquire a large enough sample.

Even though many species of meadow birds have been experiencing declines regionally and globally, few agencies are actively monitoring this group of species. At the onset of the long-term terrestrial fixed plot monitoring program no standardized protocols for monitoring meadow bird species could be found. For this reason, the Toronto and Region Conservation Authority (TRCA) has adapted the Ontario Forest Bird Monitoring Protocol (OFBMP) to meadow habitats. Essentially, the protocol is exactly the same but applied to a different habitat type and the timing of the surveys have been shifted to earlier in the year.

2.0 STUDY DESIGN

Ensuring a sample size that is appropriate to detect region wide trends is the primary objective of the monitoring program. However, with additional funds and resources in the future it will also be desirable to increase the sample size in order to have the ability to look at differences between three land-use zones (urban, urbanizing and rural).

***Program Objective(s)*:**

- To assess overall trend in meadow bird species richness and abundance in the TRCA region

An *a priori* power analysis was conducted in 2008 (Zorn 2008) to determine the appropriate number of monitoring plots needed to achieve sufficient power. In 2015, a further power analysis (retrospective) was conducted to ensure the appropriate number of plots are monitored for assessing spatial and temporal trends in meadow-dependent bird species richness, meadow-dependent bird abundance, and the number of L1-L3 meadow bird species. The sample sizes used in this power analysis were based on sample sizes used in TRCA (2015a).

Power was sufficient (>78%) for all analyses comparing the rural and urban zones (10 rural, 8 urban). Power was sufficient for analyzing temporal trends regionally (13 monitoring plots); however, only for meadow-dependent bird abundance. In order to improve power to an acceptable level (>87%) for meadow-dependent bird species richness it is recommended to increase the effect size from 10% over 5 years to 20% over 5 years. This means that instead of being able to detect a decline of 10% over 5 years our data are only able to detect a decline of 20% (or greater) over 5 years. In order to improve power for the number of L1-L3 meadow bird species it is recommended to increase the effect size to 25% and to shift the baseline year from 2008 to 2011.

Power was low for analyzing temporal trends in the rural zone alone. In order to improve power to an

acceptable level (>80%) for meadow-dependent bird species richness, it is recommended to increase the effect size from 10% over 5 years to 25% over 5 years. In order to improve power to an acceptable level (>80%) for meadow-dependent bird abundance and the number of L1-L3 meadow bird species, it is recommended to shift the baseline year from 2008 to 2011.

Power was low for analyzing temporal trends in the urban zone alone for meadow-dependent bird richness and the number of L1-L3 species; however, it was decided that it is more important to examine potential losses in the rural zone given the small number of sensitive meadow bird species currently in the urban zone. Full details of the 2015 power analysis can be found in TRCA (2015b).

3.0 EQUIPMENT & MATERIALS

Different materials and equipment are needed depending on whether the plot is being set-up for the very first time or if visited for seasonal monitoring (Table 1).

Table 1. List of required equipment and materials for plot set-up and seasonal monitoring activities.

Set-up Equipment	Seasonal Monitoring and Maintenance Equipment
• Compass • Aerial photo of general station area • Hand held GPS unit • ½ to ¾ m posts of iron rebar • Spray paint • Flagging tape • Pens and pencils • Clipboard • Small sledge hammer/mallet • Habitat description forms	• Compass • Map showing plot locations • Data forms • Thermometer • Watch/ stopwatch • Clipboard and pencils • Flagging tape • Binoculars • Flashlight – for early morning sites(batteries) • Bug repellent • Digital camera (optional)

4.0 PLOT SET-UP METHODOLOGY

Meadow bird monitoring stations are centred in meadow habitats that are ideally large enough to contain at least one 100 m count circle. Each station is identified by a ½ to ¾ m length of metal rebar, hammered into the ground. Where possible, enough of the rebar is left standing above ground-level and painted with spray paint to maintain visibility, but in situations where there is considerable public access (and where the station marker is likely to be removed) the rebar is hammered into the ground so that it is nearly flush with ground-level. In this way the station centre is still permanently marked but the marker does not pose a trip hazard to members of the public. The UTM coordinates of the station centre (location of metal rebar post) are recorded using a GPS unit.

In subsequent years after initial plot set-up, the stations are re-visited before the monitoring season gets underway to ensure that they can be relocated easily during the monitoring season. Stations are checked to ensure that routes are flagged with flagging tape where needed and that the center post is still present.

5.0 DATA COLLECTION METHODOLOGY

This protocol is based on the following:

Cadman, M.D., H.J. Dewar and D.A. Welsh. 1998. The Ontario Forest Bird Monitoring Program (1987-1997): Goals, methods and species trends observed. Technical Report Series No. 325, Canadian Wildlife Service. http://ontario.on.ec.gc.ca/wildlife/newsletters/fbmp05-e.html

Meadow birds are monitored twice during the field season with the first visit occurring between May 15th and May 30th, and the second visit between May 30th and June 15th, with at least 10 days between visits. Counts are conducted between 0500 and 1000 hours and at approximately the same time of day on subsequent visits from year to year. Counts are conducted when weather conditions are such that it is unlikely to reduce count numbers. Winds can not be higher than a three on the Beaufort wind scale (Table 2) and no rain.

Table 2. Beaufort wind codes (adapted from Zorn *et al.* 2004)

Beaufort Scale	Wind Speed (km/h)	Description	Visual Cues
0	2	Calm	Smoke rises vertically
1	3	Light	Smoke drifts
2	8	Light breeze	Leaves rustle
3	16	Gentle breeze	Lighter branches sway
4	24	Moderate breeze	Dust rises, branches move
5	34	Fresh breeze	Small trees sway

After arriving at the site the data sheet is filled in with the site (route) name, pre-assigned site number, observer name, date, and an indication of the weather conditions using the Beaufort wind and sky codes (Table 3) and air temperature reading. In addition the UTM zone, northing and easting are indicated.

Table 3. Beaufort sky codes odes (adapted from Zorn *et al.* 2004)

Sky Code	Description
0	Clear (no cloud at any level)
1	Partly cloudy (scattered or broken)
2	Continuous layer(s) of cloud
3	Sandstorm, dust storm, or blowing snow
4	Fog, thick dust or haze
5	Drizzle
6	Rain
7	Snow, or snow and rain mixed
8	Shower(s)
9	Thunderstorm

The counts begin as soon as possible after an observer arrives at the station. On the data form the start time and end time is noted for each station along the route along with the visit number (either 1st or 2nd). In addition, the wind direction is indicated. A short "rest" period may be required to recover from the hike to the station and also to get your ear "tuned-in". The point count is conducted by mapping all individual bird observations (both audio and visual) onto the data form over the course of a 10 minute period. The exact location is marked (for those individuals within the 100 m count circle) and movements of each individual are noted. The 10 minute period is split into two 5 minute increments "a" and "b", with each species identified as to when it was first observed (Figure 1). During the count the assistant surveyor indicates the end of the first 5 minute period so that the surveyor can record subsequent species observed accordingly, i.e., BLJAa where BLJA is the species code and "a" depicts that it was heard within the first 5 minutes of the 10 minute survey period. During the 10 minute survey period the surveyor remains standing at the station post but turns to face each of the cardinal directions in order to facilitate the accurate mapping of individual bird positions.

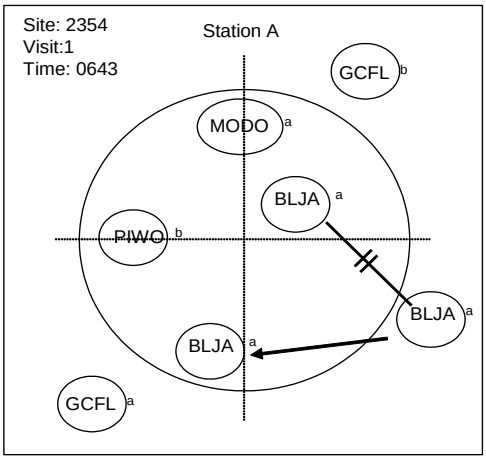

Figure 1. Sample of mapping of each bird observed during a point count.

All birds that are potentially associated with the meadow should be mapped, including birds that are flying around that seem to be associated with the meadow patch. Birds that are clearly not associated with the meadow habitat should not be counted (e.g. distant loon calls, fly-over gulls), however, it is appropriate to include species that are associated with the meadow edge. In smaller meadows it is likely that the observer will encounter species from the surrounding hedgerows; these individuals can be mapped. If the station is located in an extensive meadow or open-habitat system then it is possible that meadow bird species will be observed over great distances.

Individual birds encountered within the 100 m radius circle are mapped within the "range circle" on the provided data form; the surveyor endeavours to represent the individual in an approximation of its real position. Birds are mapped using their four letter species code and a variety of standard symbols are used to indicate the birds' behaviour and whether or not it was a male or female (Appendix A and B).

Note that during the survey:

- No pishing! The surveyor and assistant must remain silent for the entire 15 minute broadcast period.
- The assistant is not permitted to point out any birds or bird behaviour (or nests) to the surveyor. Again, it is important that observer ability/competence is standardized (consistent) so as to achieve meaningful observation of trends.

6.0 DATA MANAGEMENT AND ANALYSIS

Data Management

At the end of each field season all the data collected are entered into a corporate TRCA access database and all field collection forms are stored in a corporate filing system.

Data Analysis for the 2015 Terrestrial Long-term Monitoring Program Report (TRCA 2015a)

The TRCA Natural Heritage Monitoring database was queried and manually searched to ensure that two visits were conducted at each site over the season in each year. Bird data were retrieved using the 'Bird Yearly Analysis' link on the main page of the TRCA Natural Heritage Monitoring database. Using the Bird Yearly Analysis link ensures that the data do not include flyovers, species detected outside the 100 m radius and species that were likely migrating. Category and year were selected to retrieve relevant data. Data were then arranged into sheets in excel by site. Variables (species richness, # L1-L3 species, etc.) were calculated for each site in each year between 2008 and 2014. These data were arranged into excel tables with the site name shown in each row and year running across the top as columns. If a site contained more than one point count station, an average value was used. For example, if a specific site had 2 stations surveyed in a specific year with station 1 having 3 individuals and station 2 having 4 individuals, the average abundance for that site would be 3.5. This calculation only applies to sites with >1 station.

For both temporal and spatial analysis, summary tables with site as row and year as column were used. For temporal trends, data analysis attempted to maximize the number of years with the same list of sites consistently surveyed each year. This often resulted in limiting the number of sites included because new sites were added in more recent years. Keeping the same group of sites studied in each year allows for valid comparisons among years. The list of sites and years included for the temporal analysis can be found in the appendix of TRCA (2015a). The current baseline year for the temporal data is 2008 but in future years a later baseline year may be used in order to increase the number of sites included in the analysis.
Temporal trends were statistically analyzed using Mann-Kendall tests in an established Microsoft Excel™ spreadsheet provided by the Ministry of Natural Resources and Forestry. The Mann-Kendall test is a non-parametric test for identifying monotonic trends in time series data. This test was chosen over traditional regression analyses because the data did not meet the assumption of independent samples required for regression analyses. When analyzing time-series data, data collected at the same site from one year to the next are not independent. This made the Mann-Kendall test the best option. The Mann-Kendall test uses the S statistic to determine an associated p-value. If the value of S is zero, there is no trend in the data. If a data value from a later time period is higher than a data value from an earlier time period, S is incremented by one. On the other hand, if a data value from a later time period is lower than a data value sampled earlier, S is decremented by one. The net result of all such increments and decrements yields the final value of S (TRCA 2011). For example, a very high positive value of S is an indicator of an increasing trend, and a very low negative value indicates a decreasing trend (TRCA 2011). A p-value of less than 0.05 denotes a significant trend (increasing or decreasing) and a p-value of greater than 0.05 indicates that there is no increase or decrease over time and that the variable of interest is stable.

For spatial analysis, data analysis attempted to maximize the number of sites. This often resulted in using more recent years of data because new sites were added in more recent years. Often the most recent 2-4 years of data were used because they contained a consistent set of sites in each year. An average value across the selected years was calculated for each site and this single value per site

was used for analysis. The list of sites and years included for the spatial analysis can be found in the appendix of TRCA (2015a).

Spatial trend analysis was conducted using SAS JMP statistical software (SAS Institute Inc. 2008). Differences between urban and rural land use zones were analyzed using independent t-tests. An independent t-test is a parametric test that compares the mean value between two groups (e.g. urban and rural land use zones). This test is reported using the test statistic, t, and an associated p-value where a p-value of less than 0.05 indicates a difference between groups. A p-value of greater than 0.05 indicates that there is no difference between groups. Before performing t-tests, all data were checked for normality and homoscedasticity because these are two assumptions of using parametric statistics. If these assumptions were not met, data transformations were attempted to improve normality or heteroscedasticity. If data transformations were not effective, a Wilcoxon test was conducted (Z-statistic). This is the non-parametric version of an independent t-test and is the appropriate test to proceed with if the data do not meet assumptions. For TRCA (2015a), an independent t-test was used but this may not be the appropriate test to use in the future if the data violate the assumptions of using parametric statistics listed previously.

7.0 REFERENCES

Cadman, M.D., H.J. Dewar and D.A. Welsh. 1998. The Ontario Forest Bird Monitoring Program (1987-1997): Goals, methods and species trends observed. Technical Report Series No. 325, Canadian Wildlife Service. http://ontario.on.ec.gc.ca/wildlife/newsletters/fbmp05-e.html

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Zorn, Paul. 2008. A *Priori* Power Analysis for Toronto and Region Conservation Authority's Regional Watershed Monitoring Program. Report prepared for TRCA. Ottawa, ON

Zorn, P., Blazeski, V., and Craig, B. 2004. Joint EMAN / Parks Canada National Monitoring Protocol for Plethodontid Salamanders.

APPENDICES

APPENDIX A: Standard Symbols Used for Meadow Bird Mapping

(Magnolia Warbler in this example)