WESTERN GREAT LAKES REGION

OWL MONITORING SURVEY

2008 Final Report

Produced for

Minnesota Dept. of Natural Resources – Nongame Region 2
Wisconsin Dept. of Natural Resources – Wildlife Management

October 2008

David A. Grosshuesch

Hawk Ridge Bird Observatory

HRBO: P.O. Box 3006, Duluth, MN 55803, www.HawkRidge.org

TABLE OF CONTENTS

Cover photo: Great Horned Owl
Photo credit: Ryan Brady

LIST OF TABLES

LIST OF FIGURES

2008 WESTERN GREAT LAKES REGION OWL MONITORING

EXECUTIVE SUMMARY

As top predators of the food chain, owls are considered good indicators of environmental health, making them important to monitor. However, there is a paucity of abundance and population status data available for most species of owls in the western Great Lakes region. Currently, few species of owls are adequately monitored using traditional avian survey methods, such as the Breeding Bird Survey (BBS) and Christmas Bird Counts (CBC). For these reasons, the Western Great Lakes Region Owl Monitoring survey was initiated in 2005. The objectives of this survey are to: 1) understand the distribution and abundance of owl species in the region, 2) determine trends in the relative abundance of owls in the region, 3) determine if trends are comparable in surrounding areas and analyze whether these trends could be scaled up or down on the landscape, and 4) determine if there are habitat associations of owl species in the region.

This was the fourth year of a collaborative effort between personnel from the Hawk Ridge Bird Observatory (HRBO), Natural Resources Research Institute (NRRI), MN-Dept. of Nat. Res. (MN-DNR), and the WI-Dept. of Nat. Res. (WI-DNR) to monitor owl populations in the western Great Lakes region. Existing survey routes were used to conduct roadside surveys in Minnesota and Wisconsin. In 2008, the number of survey periods was reduced from three to one period done between April 1 and April 15; however, the period was extended until April 22 given the relatively large number of volunteers unable to conduct a survey within the proposed time frame. This was done following the analysis of the seasonal calling activity data which suggested one survey period in April would be adequate to detect all species of interest for monitoring purposes. All survey routes consisted of 10 survey points spaced ~1.6 km (1 mile) apart. The previous 2 minute passive listening period was extended to a 5 minute passive listening period at each designated survey point along the route. This was done to begin testing detection probabilities using removal sampling, which should improve population estimates and provide a more effective evaluation of management decisions.

The number of routes assigned in 2008 was 229, with 137 in Minnesota and 92 in Wisconsin. Of the 229 assigned routes, 87 and 84 routes were surveyed in Minnesota and Wisconsin, respectively. At least two surveys were conducted for 6 of the 87 routes completed in Minnesota. The number of participants that signed up to conduct an owl survey was 162, with 121 volunteers returning completed survey sheets.

In total, 296 owls of seven species were recorded on 114 routes, with no owls recorded on 57 routes (Table 2). The top three owl species combined for Minnesota and Wisconsin were Barred Owl, Great Horned Owl, and Northern Saw-whet Owl, respectively. In Minnesota, a total of 104 individual owls comprising six species were recorded. The mean number of owls/route was 1.13 compared to 1.09 in 2007. In Wisconsin, a total of 192 individual owls comprising six species were recorded. The mean number of owls/route was 2.29 compared to 2.01 in 2007.

Recommendations and future perspectives for the Western Great Lakes Region owl survey include: 1) provide training workshops for volunteers, 2) developing an on-line data entry system, 3) complete the analysis of seasonal calling activity data, 4) begin conducting analysis of owl habitat associations, owl distributions, and climatic variables influencing owl calling activity, and 5) considering the importance of using and collecting small mammal data.

INTRODUCTION

There is increasing concern about the distribution, population status, and habitat loss for both diurnal and nocturnal raptors (Newton 1979, Gutierrez *et al*. 1984, Wellicome 1997, Takats *et al*. 2001). Birds of prey occupy the top of the food chain and may be susceptible to environmental toxins and contaminants, making them important to monitor as indicators of environmental health (Johnson 1987, James *et al*. 1995, Duncan and Kearns 1997, Francis and Bradstreet 1997). Further understanding of the distribution, relative abundance, and density of wildlife populations would be valuable to make sound management decisions (Mosher and Fuller 1996).

Currently, there is a paucity of abundance and population status information available for most owl species in the western Great Lakes region. Due to their nocturnal behavior and time of breeding, owls often go undetected using traditional avian population monitoring methods (e.g. Breeding Bird Survey routes, Breeding Bird Atlases, Christmas Bird Counts, and migration monitoring). Breeding Bird Surveys and Breeding Bird Atlases are conducted in the morning, when few owls are vocal, and occur after the breeding season for most owl species in North America. Christmas Bird Counts are also done outside of the breeding season and may not detect resident owl species. Migration monitoring is presumably the best alternative method to monitor owl populations, but it may not be suitable to detect all owl species, as well as determining reliable trends. Therefore, a large scale, long-term owl survey in the Western Great Lakes region would be beneficial to monitor owl populations.

In 2008, the HRBO, in collaboration with the NRRI, MN-DNR, and WI-DNR, coordinated the fourth year of a volunteer-based roadside owl survey to monitor owl populations in the western Great Lakes region. Standardized methods developed by existing surveys in the United States and Canada were implemented to increase the statistical power to monitor owl population trends in North America (Takats *et al.* 2001, Hodgman and Gallo 2004, Monfils and Pearman 2004, Paulios 2005). The objectives of this survey are to: 1) understand the distribution and abundance of owl species in the region, 2) determine trends in the relative abundance of owls in the region, 3) determine if trends are comparable in surrounding areas and analyze whether these trends could be scaled up or down on the landscape, and 4) determine if there are habitat associations of owl species in the region.

This report summarizes the results of the 2008 Western Great Lakes Region spring owl survey conducted in Minnesota and Wisconsin, and briefly discusses a few recommendations and future perspectives.

METHODS

A standardized protocol, developed in 2005 from currently existing owl survey protocols, was used in 2008 to conduct a volunteer-based survey in Minnesota and Wisconsin. The use of standardized methods to monitor owl populations will provide comparable data throughout North America (Morrell et al. 1991, Takats et al. 2001).

CURRENT PROTOCOL

In both Minnesota and Wisconsin, each survey route consisted of 10 survey stations spaced ~1.6 km (1 mile) apart. The previous 2 minute "passive" listening period was increased to a 5 minute passive listening period to begin testing detectability probabilities. Playbacks were not used given the logistical and standardization concerns with broadcast equipment.

At the start and finish of an owl survey route, the temperature, cloud cover, precipitation level and type, and snow cover and depth was recorded. At each survey station, the time, wind speed, and noise level was recorded. Volunteers were asked to record each owl detected on the data sheet, including direction (Azimuth bearing) and estimated distance [Categories = 1) ≤ 100 m, 2) > 100 m to 500 m, 3) >500 m to 1000 m, 4) >1000 to 1500 m, and 5) >1500 m]. Additionally, volunteers were asked to record the time interval when each owl detected was heard (e.g. in first minute, in second minute, in third minute, etc.). Volunteers were asked to conduct surveys on days with minimal wind (≤ 25 km/hr) and little or no precipitation.

SURVEY TIMING

Minnesota and Wisconsin. The number of owl survey periods was reduced from three periods (Period 1 = 10 March to 18 March, Period 2 = 19 March to 8 April, Period 3 = 9 April to 22 April) to one period (1 April to 15 April). Justification for reducing the number of surveys to one period can be found in the *Discussion* section. Volunteers unable to conduct a survey from 1 April to 15 April were requested to conduct the survey when possible. Surveys started at least one half-hour after sunset and finished when the volunteer completed the route(s).

ROUTE SELECTION

Minnesota. Owl surveys were conducted along currently existing randomized routes. The MN-DNR Frog/Toad survey routes were used as the base to conduct owl surveys. There are ~138 Frog/Toad survey routes randomly located in a variety of habitat types throughout Minnesota. The start point for the owl survey route corresponded with the start point of the Frog/Toad route.

Additionally, the 31 new routes identified in the Laurentian Forest Province of Minnesota in 2006 were again used in 2008. These routes were randomly selected implementing the same protocol used to identify the initial Frog/Toad survey routes. There are currently 82 survey routes in the Laurentian Forest Province of Minnesota and 87 routes throughout the remainder of southern and western Minnesota.

Wisconsin. Owl surveys were conducted along currently existing randomized routes. Breeding Bird Survey (BBS) routes were used as the base to conduct owl surveys. There are 92 active BBS routes located in a variety of habitat types throughout the state. The start point for the owl survey route corresponded with the start points of the BBS route.

In both states, survey routes were generally located along secondary roads. However, it was difficult to ascertain whether or not an owl survey route would be drivable in late winter/early spring, given that both

Frog/Toad and BBS surveys occur during the late spring or summer. If a participant encountered an unplowed route, the survey was postponed until a later date, altered in its direction, or eliminated.

DATA COLLECTION/ANALYSIS AND DATABASE STRUCTURE

Data collection/analysis. Volunteers were asked to record all owls detected, seen or heard, at each designated station along the route, keeping track of the direction and estimated distance for each owl**.** Additionally, participants were asked to document the time interval for each owl detected during the 5 minute listening period (e.g. first minute, second minute, third minute, etc.). The number of owls for each route was determined by eliminating any birds a participant detected from a previous station. Volunteers were requested to record other nocturnal species, such as American Woodcock, Common Snipe, and Ruffed Grouse, detected on survey routes.

Data comparisons between 2008 and 2005 – 2007 for this report were based only on owls recorded during April 1 to April 22 in Minnesota and during April 1 to April 21 in Wisconsin. Seasonal calling activity data, referred to as "timing" hereafter, presented in this report was based on the analysis of data collected from 2005 – 2007 for all Barred, Great Horned, and N. Saw-whet Owls detected. Timing data were analyzed between 10 March and 30 April using 7 day intervals (i.e. 10 March to 16 March = week 1..... 24 April to 30 April = week 7). No analysis was done for other species given the limited number of detections. Differences in timing were analyzed using data for both states combined, for states separately, and between years. Significant differences were based on a p-value < 0.05.

Database structure. Data collected by volunteers were computerized into a Microsoft Excel database. The data were separated into three database files which included: 1) general survey data (including overall weather data), 2) station survey data (including station weather and additional species data), and 3) owl data.

RESULTS

VOLUNTEER PARTICIPATION

In 2008, 162 volunteers signed up to conduct owl surveys in Minnesota and Wisconsin, with 121 participants (75%) surveying at least one route. In total, 229 survey routes were assigned to volunteers, with 137 in Minnesota and 92 in Wisconsin. In Minnesota, 56 volunteer teams returned data sheets for 87 routes. Thirty-seven volunteer teams surveyed 1 route, seventeen volunteer teams surveyed 2 routes, and two volunteer teams surveyed 3 routes. In Wisconsin, 65 volunteer teams returned data sheets for 84 routes in Wisconsin. Fifty volunteer teams surveyed 1 route, twelve volunteer teams surveyed 2 routes, two volunteer teams surveyed 3 routes, and one volunteer team surveyed 4 routes.

SURVEY TIMING AND WEATHER

Minnesota. Given that 13 of the 87 routes were surveyed after 15 April, the survey period was extended until April 22. The mean survey date for all routes was 10 April (Table 1). The mean start and end temperatures for all routes was 37.9 °F and 33.4 °F, respectively. The mean wind speed code, based on the Beaufort scale, for all routes was 1 (1 – 3 mph). The mean sky code for all routes was 1 (26 – 50% cloud cover).

Wisconsin. Given that 15 of the 84 routes were surveyed after 15 April, the survey period was extended until April 21. The mean survey date for all routes was 11 April (Table 1). The mean start and end temperatures for all routes was 42.5 °F and 38.7 °F, respectively. The mean wind speed code, based on the Beaufort scale, for all routes was 1 (1 – 3 mph). The mean sky code for all routes was 1 (26 – 50% cloud cover).

Table 1. ***The mean survey dates from 2005 – 2008 for Minnesota and Wisconsin. The number of survey periods was reduced from three to one period (1 April to 22 April) in 2008.***

	Minnesota			Wisconsin		
Year	**1**	**2**	**3**	**1**	**2**	**3**
2005	17 March	4 April	19 April	—	4 April	20 April
2006	16 March	1 April	18 April	17 March	31 March	18 April
2007	14 March	1 April	17 April	14 March	30 March	18 April
2008	10 April			11 April		

OWL ABUNDANCE AND DISTRIBUTION

In total, 296 owls of seven species were recorded on 114 routes, with no owls being detected on 57 routes (Table 2). The top five owl species combined between Minnesota and Wisconsin were Barred Owl, Great Horned Owl, Northern Saw-whet Owl, Eastern Screech Owl, and Long-eared Owl, respectively (Figure 7). The overall mean number of individual owls detected per route was 1.68, compared to 1.48 in 2007. The overall mean number of Barred Owls detected per route increased 4% compared to 2007 (0.66 to 0.68 owls/route). The overall mean number of Great Horned Owls detected per route increased by 10% compared to 2007 (0.49 to 0.55 owls/route). The overall mean number of Northern Saw-whet Owls detected per route increased by 25% compared to 2007 (0.16 to 0.22 owls/route). The overall mean number of Eastern Screech Owls detected per route increased by 33% compared to 2007 (0.04 to 0.06 owls/route). Finally, the overall mean number of Long-eared Owls decreased by 20% compared to 2007 (0.06 to 0.05 owls/route).

Table 2. ***Total number of individual owls and the number of routes each species was detected in Minnesota and in Wisconsin, 2008.***

Owl Species	Minnesota		Wisconsin	
	Individuals	**Routes**	**Individuals**	**Routes**
Barred Owl	39	23	81	30
Great Horned Owl	16	14	80	43
Northern Saw-whet Owl	26	15	12	10
Eastern Screech Owl	4	3	7	7
Long-eared Owl	3	2	5	4
Short-eared Owl	0	0	2	2
Great Gray Owl	1	1	0	0
Unknown Owl	15	12	5	5
Total	104	49[1]	192	65[2]

[1] = total number of routes with at least one owl detected in Minnesota.
[2] = total number of routes with at least one owl detected in Wisconsin.

Minnesota. A total of 104 individual owls comprising six species were recorded during all surveys (Table 3). The top three species detected in Minnesota were Barred Owl, N. Saw-whet Owl, and Great Horned Owl, respectively. The mean for Barred Owls was 0.42 owls/route, which was a slight decrease compared to 2007 (Figure 8). The mean for N. Saw-whet Owls was 0.28 owls/route, which represents a 25% increase compared to 2007 (Figure 8). The mean for Great Horned Owls was 0.17 owls/route, which represents a continued decline since 2005 (Figure 8). The highest number of individual owls detected during a survey ranged between 1 and 9, comprising between 1 and 2 species. The mean number of owls/route went up 4% compared to 2007 (1.09 to 1.13 owls/route). However, the 2008 mean of 1.13 owls/route remains 48% below the high in 2006 (2.17 owls/route).

Barred Owls were detected in 12 counties within Minnesota including: Houston, Winona, Wabasha, Scott, Pine, Aitkin, Todd, Cass, Itasca, Koochiching, St. Louis, Lake, and Cook (Figure 1). Northern Saw-whet Owls were detected in 9 counties within Minnesota including: Aitkin, Cass, Red Lake, Roseau, Koochiching, Itasca, St. Louis, Lake, and Cook (Figure 3). Great Horned Owls were detected in 13 counties within Minnesota including: Houston, Rice, Sherburne, Meeker, Stearns, Rock, Lincoln, Aitkin, Todd, Crow Wing, Cass, Roseau, and St. Louis (Figure 2).

Eastern Screech Owls were detected in three counties of Minnesota including: Houston, Wabasha, and Lincoln (Figure 4). Long-eared Owls were detected in two counties of the Minnesota including: Aitkin and Koochiching (Figure 5). One Great Gray Owl was detected in St. Louis County of Minnesota (Figure 6).

Wisconsin. A total of 192 individual owls comprising 6 species were recorded during all surveys (Table 3). The top three species detected in Wisconsin were Barred Owl, Great Horned Owl, and N. Saw-whet

Owl, respectively. The mean for Barred Owls was 0.96 owls/route, which was a slight increase compared to 2007 (Figure 9). The overall mean for Great Horned Owls was 0.95 owls/route, which represents a 12% increase compared to 2007 (Figure 9). The overall mean for N. Saw-whet Owls was 0.14 owls/route, which represents a 35% increase compared to 2007 (Figure 9). The number of individual owls detected ranged from 1 to 11, comprising between 1 and 3 species. The mean number of owls/route went up 12% compared to 2007 (2.01 to 2.29 owls/route). The mean number of owls/route has continued to increase since 2005, going up 48% from 1.20 in 2005 to 2.29 in 2008.

Barred Owls were detected in 25 counties throughout Wisconsin including: Grant, Lafayette, Jefferson, Sauk, Columbia, Fon Du Lac, Juneau, Green Lake, Waushara, Winnebago, Waupaca, Jackson, Buffalo, Pierce, Dunn, Chippewa, Clark, Oconto, Door, Forest, Vilas, Barron, Polk, Burnett, and Douglas (Figure 1). Great Horned Owls were detected in 35 counties throughout Wisconsin including: Rock, Kenosha, Iowa, Dane, Crawford, Sauk, Columbia, Dodge, Sheboygan, Green Lake, Adams, Juneau, Monroe, Vernon, La Crosse, Buffalo, Jackson, Wood, Waupaca, Manitowac, Brown, Kewaunee, Marinette, Pierce, Dunn, Chippewa, Taylor, Lincoln, St. Croix, Polk, Barron, Burnett, Sawyer, Bayfield, and Vilas (Figure 2). Northern Saw-whet Owls were detected in 9 counties in Wisconsin including: Iowa, Crawford, Green Lake, Taylor, Lincoln, Langlade, Forest, Oneida, and Sawyer (Figure 3).

Eastern Screech Owls were detected in seven counties throughout Wisconsin including: Lafayette, Iowa, Columbia, Dodge, Adams, Waushara, and Dunn (Figure 4). Long-eared Owls were detected in four counties in Wisconsin including: Grant, Jackson, Waupaca, and Rusk (Figure 5). Short-eared Owls were detected in two counties in Wisconsin including: Grant and Portage (Figure 6). This is the first time Short-eared Owls have been detected during the survey in Wisconsin.

Table 3. ***The number of observed and mean number of owls/route for Minnesota and Wisconsin, 2008.***

			Barred Owl		Great Horned Owl		N. Saw-whet Owl		E. Screech Owl		Long-eared Owl	
Region	**Date**	**# Routes**[a]	**# Obs.**[b]	**Mean**[c]	**# Obs.**	**Mean**	**# Obs.**	**Mean**	**# Obs.**	**Mean**	**# Obs.**	**Mean**
Minnesota	April 1 – 22	92	39	0.42	16	0.17	26	0.28	4	0.04	3	0.03
Wisconsin	April 1 – 21	84	81	0.96	80	0.95	12	0.14	7	0.08	5	0.06
Overall	April 1 – 22	176	120	0.68	96	0.55	38	0.22	11	0.06	8	0.05
	Total	350	195	0.56	192	0.55	96	0.27	17	0.05	16	0.05

[a] Number of routes surveyed between survey date.
[b] Number of owls detected.
[c] Average number of owls detected per route surveyed.

Table 3 (continued). ***The number of observed and mean number of owls/route for Minnesota and Wisconsin, 2008.***

Region	Date	# Routes	Short-eared Owl # Obs.	Short-eared Owl Mean	Great Gray Owl # Obs.	Great Gray Owl Mean	Total # Obs.[d]	Total Mean
Minnesota	April 1 – 22	92	—	—	1	0.01	104	1.13
Wisconsin	April 1 – 21	84	2	0.02	—	—	192	2.29
Overall	April 1 – 22	176	2	0.02	1	0.01	296	1.68
	Total	350	12	0.03	7	0.02	536	1.53

[d]Total # observed includes 14 and 5 unknown owl species in MN and WI, respectively.

SEASONAL VARIATION IN CALLING ACTIVITY

Barred Owl. Data were analyzed for 2005 – 2007 for differences in timing for both states combined, as well as differences in timing between states and years. When combining data from both states, there was a significant difference ($p < 0.01$) in the timing of Barred Owl detections. In general, there was an increasing trend in the mean number of detections from week 1 to week 6 before sharply declining in week 7 (Figure 10). No significant difference ($p = 0.76$) was found in the timing between states. In both states there appeared to be an increasing trend in detections from week 1 to week 6 (Figure 11 and 12). Additionally, there was no significant difference found in the timing between years ($p = 0.16$).

Great Horned Owl. Data were analyzed for 2005 – 2007 for differences in timing for both states combined, as well as differences in timing between states and years. When combining data from both states, there was no significant difference ($p = 0.17$) in the timing of Great Horned Owl detections. The mean number of detections appears to show a decline from week 3 to week 7; however, the decline observed from week 3 to week 6 was minimal (Figure 13). There was no significant difference ($p = 0.08$) found in the timing between states. Although no significant difference was found, the trend observed in Minnesota seems to be relatively flat compared to the trend observed in Wisconsin, which appeared to show a decline from week 1 to week 7 (Figure 14 and 15). Additionally, no significant difference ($p = 0.40$) was found in the timing between year.

Northern Saw-whet Owl. Data were analyzed for 2005 – 2007 for differences in timing for both states combined, as well as differences in timing between states and years. When combining data from both states combined, there was no significant difference ($p = 0.06$) in the timing of N. Saw-whet Owls. Although no significant difference was found, the trend observed shows an increasing trend from week 1 to week 6, with a sharp decline in week 7 (Figure 16). No significant difference ($p = 0.12$) was found in the timing between states. The trend observed in Minnesota follows the overall trend by showing an increase in detections from week 1 to week 6 with a decline in week 7 (Figure 17). In contrast, the trend observed in Wisconsin is more bimodal in appearance, with a peak in week 3 and week 5 (Figure 18). There was, however, a significant difference ($p = 0.04$) found between the timing and year.

ADDITIONAL SPECIES

Volunteers recorded a total of 22 additional species while conducting an owl survey. Twenty-one species were detected in Minnesota, with the top five being American Woodcock, Canada Goose, Wilson's Snipe, Ruffed Grouse, and Killdeer (Table 4). Eleven species were detected in Wisconsin, with the top five being American Woodcock, Canada Goose, Wilson's Snipe, Sandhill Crane, and Ruffed Grouse (Table 4).

Table 4. ***Top five additional species detected during owl surveys in Minnesota and Wisconsin, 2008.***

Minnesota		Wisconsin	
Species	**Total**	**Species**	**Total**
American Woodcock	98	American Woodcock	108^+
Canada Goose	90^+	Canada Goose	48^+
Wilson's Snipe	35	Wilson's Snipe	21
Ruffed Grouse	26	Sandhill Crane	17^+
Killdeer	26	Ruffed Grouse	16

$^+$ = not quantified (estimated total).

DISCUSSION

VOLUNTEER PARTICIPATION

The number of volunteers that signed up to conduct a survey increased each year from 105 in 2005 to 162 in 2008. This is in part due to an increase in the number of routes available in northern Minnesota in 2006, as well as expanding the survey area throughout Minnesota in 2007. Despite the increase in volunteers, the proportion of assigned routes which were completed has decreased since 2005. In 2008, 75% of assigned routes were completed compared to 76% in 2007 and 85% in 2006. In 2008, the regional breakdown between Minnesota and Wisconsin was 64% and 91% of assigned routes completed, respectively. This represents a 10% decline in Minnesota but a 23% increase in Wisconsin of assigned routes completed compared to 2007. The continued decline in the proportion of routes completed in Minnesota is concerning. However, the proportion of routes completed in Minnesota is comparable to other owl surveys in North America. The large increase in the proportion of routes completed in Wisconsin may be a reflection of the effort put forth in 2008 by the WI Dept. of Nat. Res. to recruit volunteers.

It appears volunteer interest in owl monitoring remains relatively high in both states, and the decline in participation rates in Minnesota is similar to what other owl surveys in North America have experienced. Although, the biggest concern in Minnesota is that the number of assigned routes has increased, but the number of participants completing the route or returning the data sheet continues to drop. Despite this result, it is expected that participation rates will remain stable in Minnesota and Wisconsin, as several volunteers from 2007 surveyed the same routes in 2008. In 2009, volunteer recruitment will be focused on the new survey areas in western Minnesota, and a concerted effort will be made to describe the importance of returning data sheets.

OWL SURVEYS

The overall mean number of owls detected has oscillated between 2005 and 2008, with a high of 1.84 owls/route in 2006 to a low of 1.48 owls/route in 2007. The potential bias in this comparison was that all owls recorded between 1 April and 22 April for 2005 – 2007 were included. Some routes were sampled twice during this time frame, and therefore, each time the route was surveyed it would be considered an independent survey. It could be possible that the same owl was detected during each survey time, which would inflate numbers.

Regardless of this potential bias, the overall pattern observed likely reflects changes in owl populations. Given that the vast majority of owls recorded during surveys were Barred, Great Horned, and N. Saw-whet Owls, the mean numbers for these species will control the overall observed pattern. Patterns observed for Barred and Great Horned Owls have generally exhibited an increasing trend, and therefore, it seems unlikely that the oscillation observed was influenced by these species. In contrast, N. Saw-whet Owl numbers have fluctuated widely between years, and it seems plausible that this species may have influenced the overall pattern observed between 2005 and 2008. Northern Saw-whet Owls may be more cyclical, following microtine populations, than the previous two species. This may cause local or regional N. Saw-whet Owl populations to fluctuate.

Minnesota. Although the ranked order has changed from 2005 – 2008, the top three species in Minnesota remain the same: Barred Owl, N. Saw-whet Owl, and Great Horned Owl. The most notable decrease in the mean owls/route was observed in Great Horned Owls, which have declined every year since 2005. It seems unlikely this decline was caused by only including owls from 1 April to 22 April, because no significant difference was detected when analyzing the timing or timing by state data. Barred Owls exhibited a substantial decline from 2005 to 2006, but they have remained relatively stable since 2006. Grosshuesch (2007) stated that detections from 2006 to 2007 were deflated by including routes surveyed throughout the state in 2007, which was not the case in 2005 and 2006 when surveys only occurred in the Laurentian Forest Province. Therefore, the trend observed in Barred Owls may not be an accurate reflection of population status. N. Saw-whet Owl detections have fluctuated widely from 2005 – 2008, with a substantial high in 2006 and sharp decline in 2007. However, the decline in 2007 was deflated by including routes surveyed throughout the state. Regardless, the overall trend for N. Saw-whet Owls has fluctuated more than Great Horned or Barred Owls. This may indicate N. Saw-whet Owl populations may be influenced by microtine populations, suggesting they are somewhat nomadic.

Long-eared and Great Gray Owls have declined since 2006. It is widely accepted that these species are nomadic, following microtine cycles. This would suggest that in 2006 there was an abundance of prey available. If microtines in Minnesota exhibit the generally accepted 3 to 5 year cycle, then it seems likely that both species should show an increase in detections between 2009 and 2011. However, the limited number of detections and microtine data reduces the power of this speculation. Eastern Screech Owls were the only other species detected in 2008; however, detections for this species remain low making it difficult to draw any conclusions about population status.

Wisconsin. Although the ranked order of the top three species has changed, the top three species remain the same: Barred Owl, Great Horned Owl, and N. Saw-whet Owl. Barred and Great Horned Owls have exhibited a steady increase in detections since 2005. Perhaps winter conditions influenced survivorship for both species during the winter of 2004/2005, but since 2005, winter survivorship has been relatively high. Another possibility is that productivity was relatively low in 2004 influencing the number of owls detected in 2005, but since 2005 productivity and survivorship have been relatively high. Interestingly, N. Saw-whet Owls had a record high in 2005, followed by a substantial decrease in 2006 and slight recovery in 2007 and 2008. In contrast, Minnesota had the record high in 2006. This may suggest microtine populations were relatively high in 2005 but declined or leveled off since then in Wisconsin.

Long-eared owls exhibited a similar trend compared to N. Saw-whet Owls, with a substantial decrease from 2005 to 2006 followed by an increase in 2007 and 2008. If prey numbers were relatively high in Wisconsin in 2005 compared to Minnesota, this may explain why record highs were observed. Although, the number of Long-eared Owl detections in 2008 were similar to 2005, suggesting an alternative explanation. Eastern Screech Owls have remained mostly stable since 2006, when first detected. For both of the aforementioned species, there were limited detections making it difficult to draw any conclusions.

SEASONAL CHANGE IN CALLING ACTIVITY

Barred Owl. Based on the data analysis of Barred Owls, it appears that detections significantly increased over time, despite a sharp decline in week 7. This suggests that a surveyor is more likely to detect a Barred Owl in April compared to March. There was also no significant difference detected in the timing of Barred Owls between states. This suggests that a surveyor is as likely to detect a Barred Owl during the same time frame in both states, and that the same survey period could be used in both states. Also, no difference in timing and year was detected. This suggests that Barred Owl detections were not influenced by year variables, which may include retracted or prolonged winter conditions. This may not be surprising because Barred Owls are considered resident and presumably don't exhibit extensive movements between breeding and non-breeding territories. The timing data suggests that one survey period in April should be adequate in both states to monitor trends.

Great Horned Owl. No difference was found in the timing of Great Horned Owl detections, but the trend does show a slight decline in detections from week 3 to week 7. This suggests that a surveyor may be more likely to detect an owl in early April compared to late April. Although no significant difference was found in the timing of detections between states, it did appear that a surveyor in Wisconsin may be more likely to detect an owl earlier than in Minnesota. In Minnesota, it appears a surveyor is as likely to detect an owl in March as in April. There was also no difference found between timing and year. This suggests that Great Horned Owl detections were not influenced by year variables, which may include retracted or prolonged winter conditions. This may not be surprising because Great Horned Owls are considered resident and presumably don't exhibit extensive movements between breeding and non-breeding territories. The timing data suggests that one survey period in April would be adequate to monitor trends in Minnesota. The same probably holds true in Wisconsin, although, detections may be somewhat reduced if routes were only surveyed in mid to late April.

Northern Saw-whet Owl. Although no significant difference was found in the timing of N. Saw-whet Owl detections, it does appear there is an increasing trend in detections from week 1 to week 6. This suggests a surveyor is more likely to detect an owl in April compared to March. Also, no significant difference was found between timing and state, but the trend observed in Wisconsin does appear to be different than the trend in Minnesota. The Minnesota trend is more similar to the overall trend for both states combined, while the trend in Wisconsin seems more bimodal in appearance. The bimodal trend may be a reflection of detecting some owls still migrating during the peak in week 3, while detecting potential breeding owls during the peak in week 5. In Minnesota, the trend remained relatively flat from week 2 to week 6, which may be a reflection of detecting both migrating and breeding owls throughout that period. Regardless, it appears a surveyor is more likely to detect an owl in April compared to early to mid March. There was a significant difference found between timing and year. This suggests that N. Saw-whet Owl detections may be influenced by year variables, such as retracted or prolonged winter conditions or by microtine population cycles. This result may not be surprising because N. Saw-whet Owls are migratory and may be influenced in their northward migration by winds and temperatures. The timing data suggests that one survey period in April should be adequate to monitor trends in both states.

Summary

The purpose of conducting surveys during three periods (March to April) was to provide data on the seasonal calling activity of owls in the region, which would then be used to make informed decisions about the protocol. The goal was to have a protocol that minimized effort with maximized results to monitor owl population trends, and ultimately, implementing an adaptive protocol without compromising the data previously collected. The statistical analysis done on the timing data has provided us with the best information available on the calling activity for the top three species. The data suggests that the top three species are either just as or more likely to be detected in April compared to March. The data also suggests that state and yearly differences in timing had a minimal influence on calling activity. Therefore, the modified protocol of conducting surveys during one period in April should be adequate to detect relatively high numbers of the top three species, and also, that using one protocol for both states will be appropriate to monitor trends.

RECOMMENDATIONS AND FUTURE GOALS

1) We will extend the survey period to April 21 to allow enough time for volunteers to complete their survey.

2) We would like to increase the number of participants conducting surveys in southern and western Minnesota. To achieve this we will contact and recruit volunteers well in advance of the looming survey period.

3) We would like to add routes in Wisconsin to provide more opportunities for volunteers and increase the statistical power to monitor population trends.

4) We continue to work with staff from Bird Studies Canada about the possibility of integrating an on-line data entry system for volunteers. This will reduce the number of mailings, and it will make data access easier for volunteers.

5) We would like to begin an analysis to better understand habitat associations of owls, as well as climatic influences on calling activity in the Western Great Lakes region.

6) As future data continues to be collected, a trend analysis will be done to determine changes in owl populations.

7) Lastly, it would be extremely valuable to collect data on small mammal populations. Currently, limited small mammal data is available, but it may prove valuable to include such information when interpreting trend abundance and distribution data. In the future, it may be possible to work collaboratively with other resource organizations collecting such data.

ACKNOWLEDGMENTS

Thanks to the Minnesota Dept. of Natural Resources for funding this project, and the Wisconsin Dept. of Natural Resources for taking over volunteer coordination in Wisconsin and providing on-line training/certification. Thanks to Ryan Brady, of the WI – DNR, for reviewing the report. Thanks to Jerry Niemi, of NRRI, for providing logistical support. Thanks to Ron Regal, of the Univ. of MN-Duluth, for helping with database formatting and statistical analysis. Thanks to Rich Baker, of the MN-DNR, for providing information and maps for MFTCS routes throughout Minnesota. Thanks to Debbie Waters, of HRBO, for helping with website logistics. Finally, special thanks to Julie O'Connor, of HRBO, for helping with logistics and volunteer recruitment and coordination in Minnesota.

Most importantly, I would like to thank the volunteers that made this project possible! Participants deserve special thanks for generously donating their time and money driving many miles to conduct owl surveys. The amount of energy and enthusiasm volunteers expressed is greatly appreciated, and it will surely help with the continuation of this survey! Thanks again for your dedication in providing valuable information about owls in the western Great Lakes region.

LITERATURE CITED

Duncan, J.R. and A. E. Kearns. 1997. Habitat association with barred owl (*Strix varia*) locations in southeastern Manitoba: a review of a habitat model. In: Biology and Conservation of Owls of the Northern Hemisphere by J.R. Duncan, D.H. Johnson, and T.H. Nicholls (eds.). USDA Forest Service General Technical Report NC-190. Pp. 138-147.

Francis, C.M. and M.S.W. Bradstreet. 1997. Monitoring Boreal Forest Owls in Ontario using Tape Playback Surveys with Volunteers. In: Biology and Conservation of Owls of the Northern Hemisphere by J.R. Duncan, D.H. Johnson, and T.H. Nicholls (eds.). USDA Forest Service General Technical Report NC-190. Pp. 175-184.

Grosshuesch, D. A. 2007. Western Great Lakes Region Owl Monitoring Survey: 2007 Final Report. Annual report, Minnesota and Wisconsin Dept. of Nat. Res., Pp. 26.

Gutierrez, R.J., D.M. Solis, and C. Sisco. 1984. Habitat ecology of the spotted owl in northwestern California: implications of management. Proceedings of the Society of American Foresters 1983. Pp. 368-373.

Hodgman, T.P. and S.M. Gallo. 2004. Conservation Status and Volunteer Monitoring of Maine Owl Populations. Annual report, Maine Outdoor Heritage Fund. Pp. 16.

James, P.C., K.M. Mazur, and S.D. Frith. 1995. The barred owl as an indicator of old forest and its role in long-term forestry planning. Annual report, Saskatchewan Environment and Resource Management. 27pp.

Johnson, D.H. 1987. Barred owls and nest boxes: results of a five-year study in Minnesota. In: Biology and Conservation of Northern Forest Owls by R.W. Nero, R.J. Clark, R.J. Knapton, and R.H. Hamre (eds.). USDA Forest Service Technical Report RM-142. Pp. 129-134.

Monfils, M.J. and P.B. Pearman. 2004. Woodland Owl Surveys in Support of the Michigan Breeding Bird Atlas II: Distribution, Abundance, and Survey Effectiveness. Annual report, Michigan Dept. of Nat. Resources-Wildlife Division, Natural Heritage Program. 40 Pp.

Morrell, T.M. R.H. Yahner, and W.L. Harkness. 1991. Factors affecting detection of Great Horned Owls by using broadcast vocalizations. Wildlife Society Bulletin 19(4): 481-488.

Mosher, J.A. and M.R. Fuller. 1996. Surveying woodland hawks with broadcasts of Great Horned Owl vocalizations. Wildlife Society Bulletin 24(3): 531-536.

Newton, I. 1979. Population ecology of raptors. Buteo Books, Vermillion, SD. Pp. 13-17.

Paulios, A. 2005. Habitat Selection and Distribution of Owls in the Nicolet National Forest, WI, USA. M.S. Thesis. University of Wisconsin, Green Bay.

Takats, D.S., D.L., C.M. Francis, G.L. Holroyd, J.R. Duncan, K.M. Mazur, R.J. Cannings, W. Harris, D. Holt. 2001. Guidelines for Nocturnal Owl Monitoring in North America. Beaverhill Bird Observatory and Bird Studies Canada, Edmonton, Alberta. 32 pp.

Wellicome, T. 1997. Status of the burrowing owl (*Speotyto cunucularia hypugaea*) in Alberta. Alberta Environmental Protection, Wildlife Management Division, Wildlife Status Report No. 11. 21 pp.

Figure 1: Barred Owl locations in 2008.

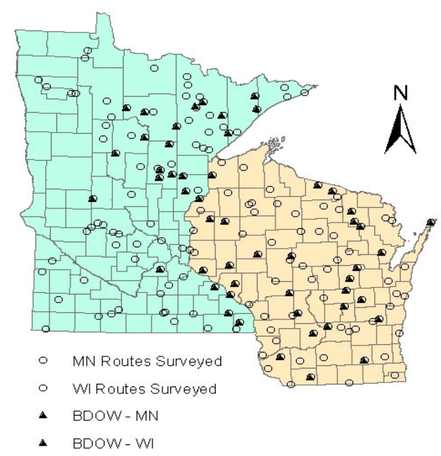

Figure 2: Great Horned Owl locations in 2008.

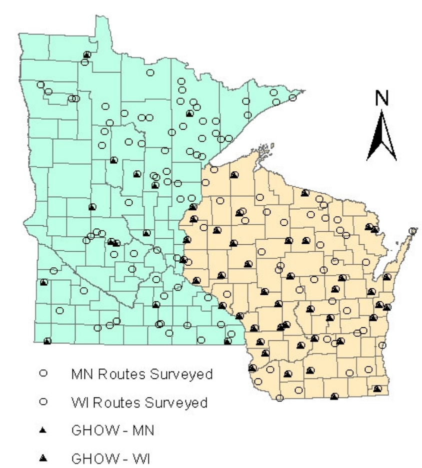

Figure 3: N. Saw-whet Owl locations in 2008.

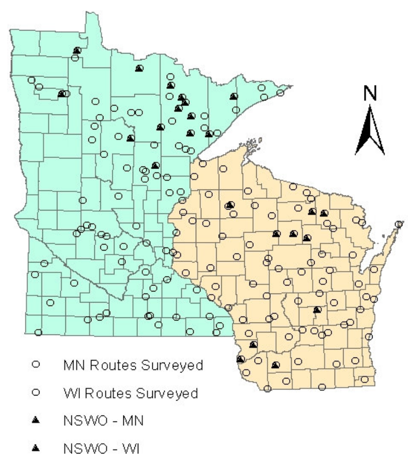

Figure 4: Eastern Screech Owl locations in 2008.

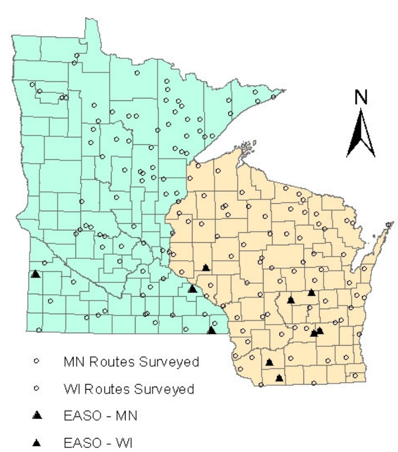

Figure 5: Long-eared Owl locations in 2008.

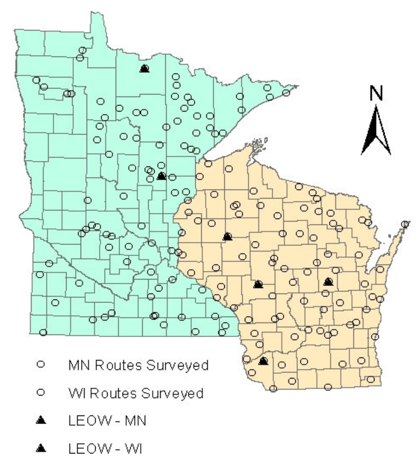

Figure 6: Great Grey and Short-eared Owl locations in 2008.

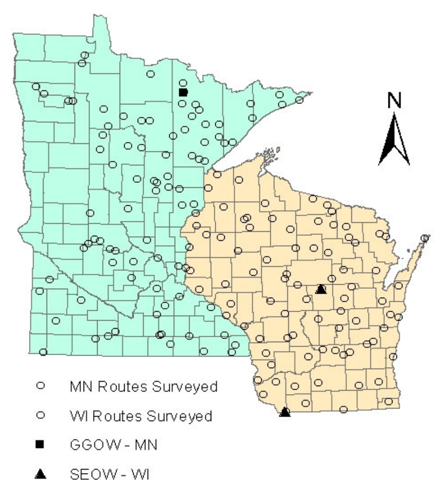

Figure 7: Mean # owls/route for Minnesota and Wisconsin combined, 2005 - 2008.

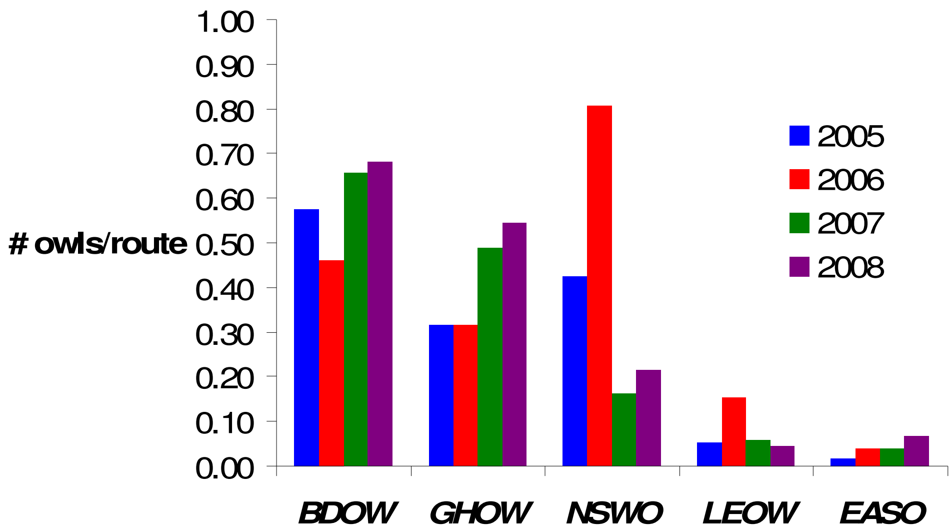

Figure 8: Mean # owls/route for Minnesota, 2005 - 2008.

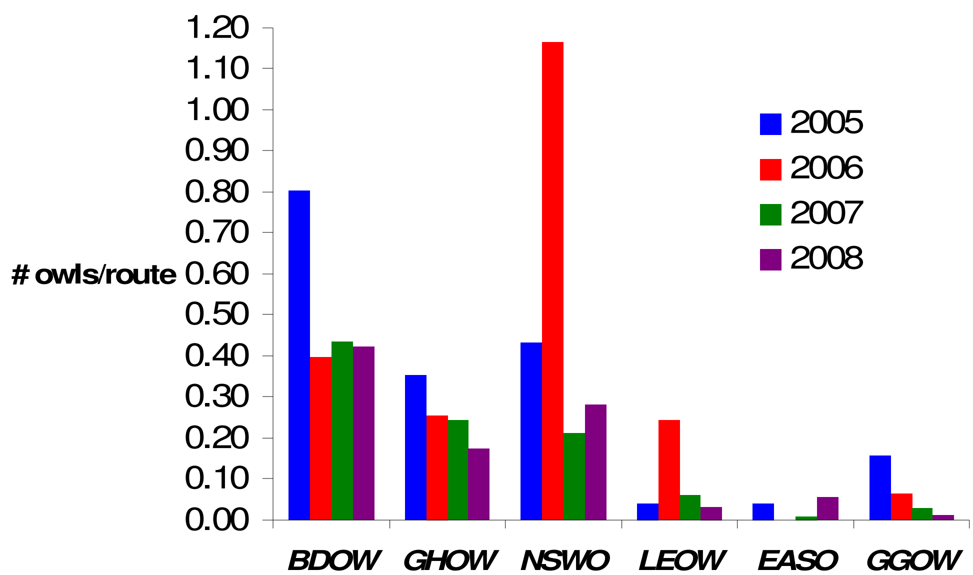

Figure 9: Mean # owls/route in Wisconsin, 2005 - 2008.

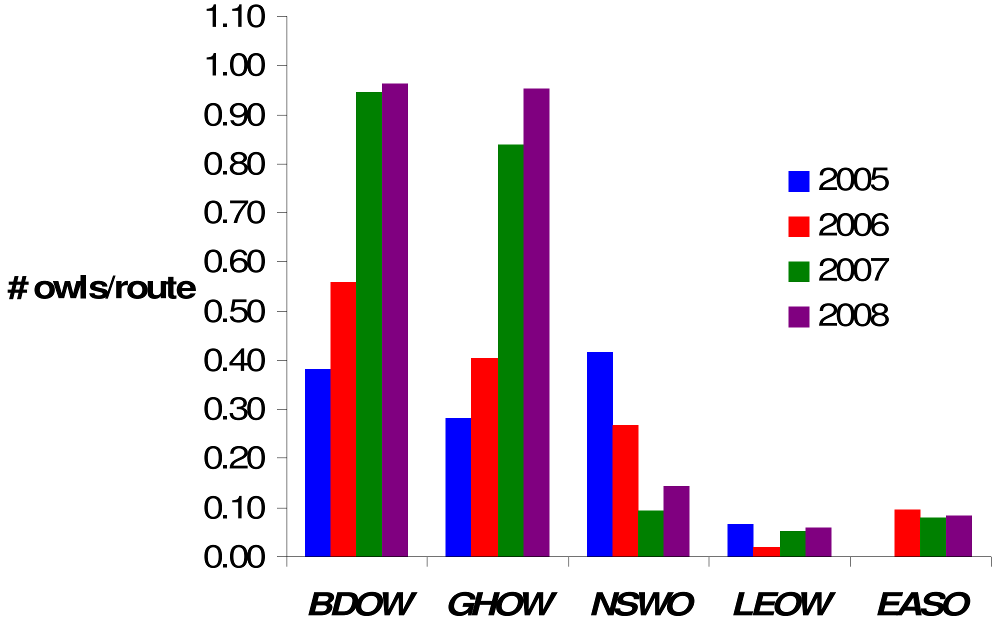

Figure 10: Mean number of Barred Owls during 7 day intervals (from 10 March to 30 April) for MN and WI, 2005 - 2007.

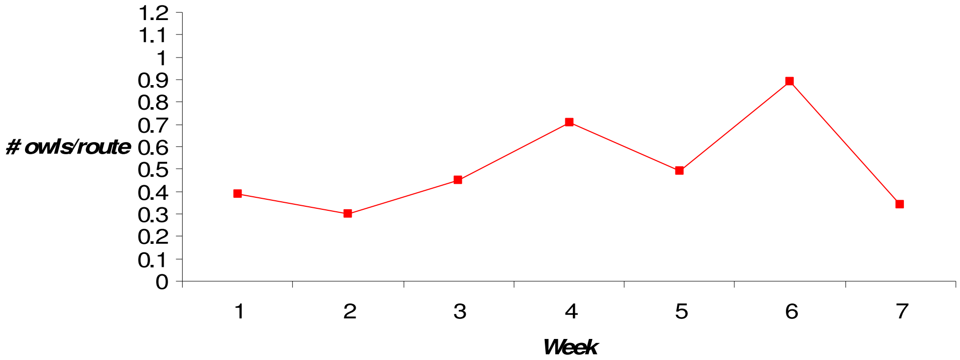

Figure 11: Mean number of Barred Owls during 7 day intervals (from 10 March to 30 April) in MN, 2005 - 2007.

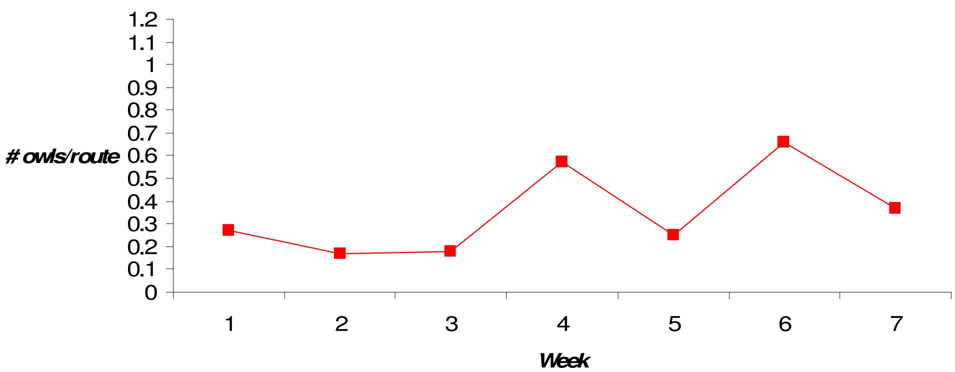

Figure 12: Mean number of Barred Owls during 7 day intervals (from 10 March to 30 April) in WI, 2005 - 2007.

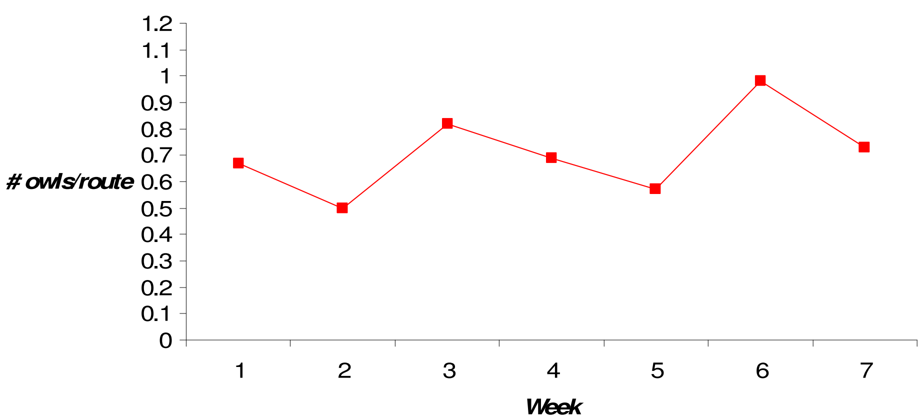

Figure 13: Mean number of Great Horned Owls during 7 day intervals (from 10 March to 30 April) for MN and WI, 2005 - 2007.

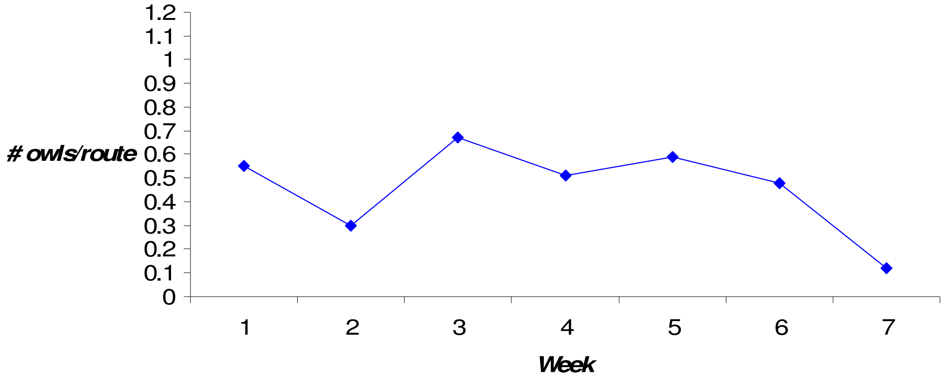

Figure 14: Mean number of Great Horned Owls during 7 day intervals (from 10 March to 30 April) in MN, 2005 - 2007.

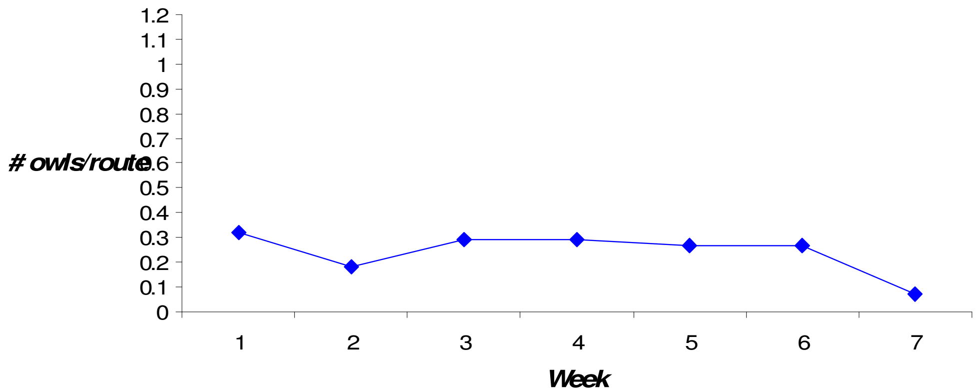

Figure 15: Mean number of Great Horned Owls during 7 day intervals (from 10 March to 30 April) in WI, 2005 - 2007.

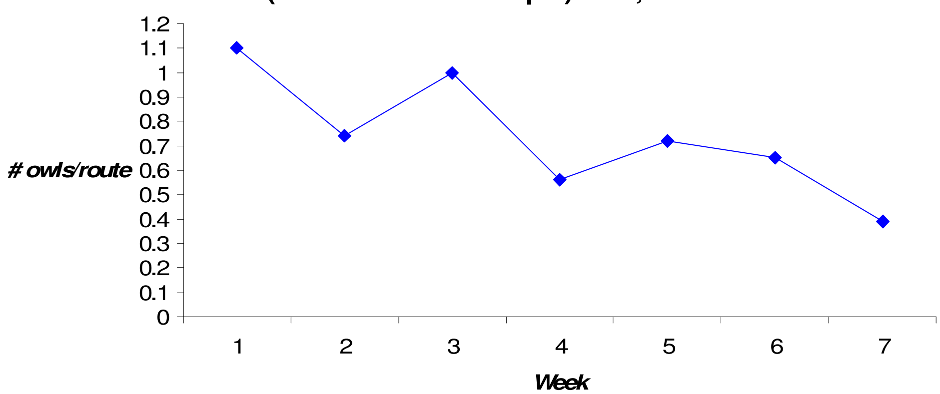

Figure 16: Mean number of N. Saw-whet Owls during 7 day intervals (from 10 March to 30 April) for MN and WI, 2005 - 2007.

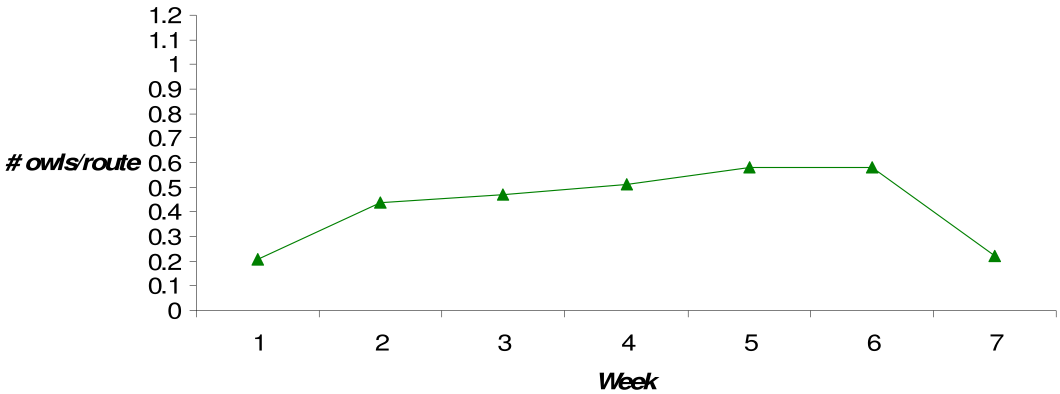

Figure 17: Mean number of N. Saw-whet Owls during 7 day intervals (from 10 March to 30 April) in MN, 2005 - 2007.

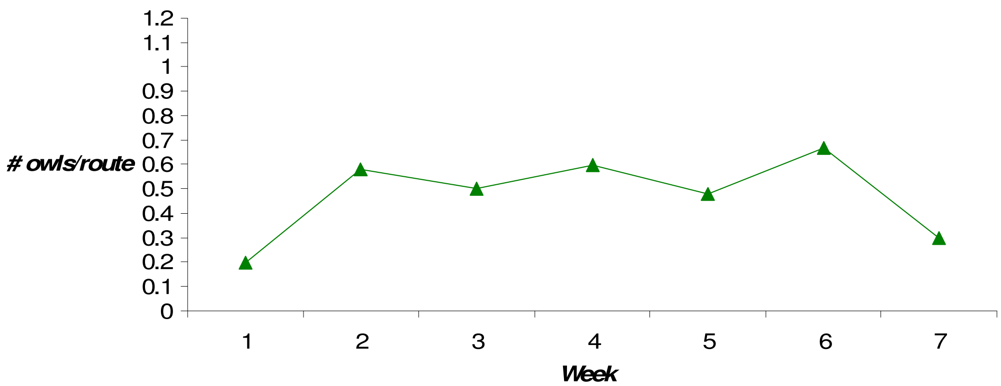

Figure 18: Mean number of N. Saw-whet Owls during 7 day intervals (from 10 March to 30 April) in WI, 2005 - 2007.