

Wisconsin Red-shouldered Hawk Survey

2010 Annual Report



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SUMMARY

In 2010, the Wisconsin Bird Conservation Initiative and WDNR's Bureau of Endangered Resources launched a pilot survey to assess the statewide abundance, distribution, and population trend of the Red-shouldered Hawk (*Buteo lineatus*; RSHA), a Threatened species and Species of Greatest Conservation Need in Wisconsin. Observers conducted two early morning surveys of a pre-established route between late March and early May. Routes included 12 stops spaced a mile apart to cover a length of 11 miles. Most occurred along roads but those in the Driftless Area of western Wisconsin were river-based and surveyed by canoe or boat. Observers used playback equipment (mp3/CD player and portable speakers) to broadcast RSHA territorial calls at each 10-minute stop.

A mix of 41 citizen volunteers and biologists surveyed 42 of the 54 routes randomly placed within suitable RSHA habitat statewide. Overall they detected 110 RSHAs at 84 unique stations on 23 routes, including 69 detections on the first survey and 41 detections on the second. Sixty-six of 110 RSHA detections (60%) occurred along river systems within the Driftless Area's Western Coulees & Ridges Ecological Landscape in west-southwest Wisconsin, with 57 of these occurring on six routes along the Lower Wisconsin and Black Rivers. Eighty-two percent of RSHA responses occurred during active playback within the first six minutes of the survey period. A binomial-Poisson mixture model estimated detection rate to be 0.45 (95% CI: 0.28 – 0.61) and mean abundance per route as 3.12 (95% CI: 2.09 – 4.84). More detailed analyses, include habitat relationships, will be performed following a second year of surveys in spring 2011.

BACKGROUND

The Red-shouldered Hawk (*Buteo lineatus*; RSHA) is a Species of Greatest Conservation Need in Wisconsin due to its status as a state Threatened species (WDNR 2005). However, we currently have a limited sense of this species' abundance and distribution in the state because previous work has focused largely on intensive monitoring of nest site parameters at more local scales (Jacobs and Jacobs 2002, King 2008, Kreitinger and Paulios 2007). Some qualitative evidence also suggests this species may be more common in Wisconsin than previously thought and/or increasing its population statewide. The Wisconsin All-Bird Conservation Plan identifies statewide monitoring using conspecific playback in suitable habitat as a priority research need for this species (Kreitinger and Paulios 2007).

The new Wisconsin Red-shouldered Hawk Survey, a project of the Wisconsin Bird Conservation Initiative (WBCI) and WDNR's Bureau of Endangered Resources, is designed to assess these issues by generating population abundance and trend estimates for RSHAs throughout the state during breeding season, which will allow for an updated status assessment and inform strategic habitat management goals for this species and the large blocks of mature forests on which it depends. In its inaugural 2010 season, citizen volunteers and professional biologists used playback methodology to conduct road- and river-based transect surveys along randomly-selected routes across Wisconsin.

METHODS

Route Selection

To meet project objectives, routes to be surveyed were selected randomly from available habitat suitable for RSHAs, which we defined using a variety of landscape and site-level habitat features. In the Driftless Area of western Wisconsin, we identified suitable habitat as WISCLAND category 223, “Forested Wetland – broad-leaved deciduous” (WNDR 2009) and survey routes were located along navigable rivers. Outside of the Driftless Area, we developed a habitat suitability index model based on focal mean analysis of WISCLAND and soils data at known RSHA nest sites from the Natural Heritage Inventory database. The analysis generated five habitat quality categories scoring 0 – 4 and we targeted routes along roads within the two highest scores.

We randomly selected route starting points within suitable habitat using a Generalized Random Tessellation Stratified procedure (GRTS). We then moved each starting point to the nearest river access point or road intersection and directed all river routes downstream. Road routes were steered through suitable habitat, with directions chosen randomly (coin flips) when more than one option was available. All routes included 12 survey stations spaced at one mile intervals (odometer-style) and covered a length of 11 miles.

Survey Timing and Replication

Observers surveyed each route twice during morning hours early in the breeding season, generally between late March and early May. The exact survey period was defined by latitude as shown below, with surveys in the north occurring later due to delayed nesting phenology there. All surveys began near sunrise (~0630h). Road routes took approximately three hours and river routes about five hours to complete. Most replicate surveys were spaced by at least one week and on average about two weeks within the respective survey periods. Observers did not conduct surveys if winds were >12 mph, precipitation was constant, or visibility was <1/2 mile.

- SOUTH = March 25 – April 25
- CENTRAL = April 1 – April 30
- NORTH = April 10 – May 10

***Border between SOUTH and CENTRAL is Hwy 90/94 from La Crosse to Mauston to Madison to Milwaukee.

***Border between CENTRAL and NORTH is Hwy 8 from St. Croix Falls to Ladysmith to Rhinelander to Niagara.

Survey Protocol

Each of twelve stations along a route consisted of a 10-minute survey period, including six minutes of conspecific playback followed by four minutes of passive listening. Each minute of playback included 20 seconds of RSHA vocalizations and 40 seconds of silence, with observers rotating the caller 120 degrees after each minute. If one or more RSHAs were detected at any time, the survey period was ended immediately to avoid harassing the bird(s).

For each detection, observers recorded the minute (0-10), type (e.g., auditory vs. visual), direction, and estimated distance of response. Regardless of detection, surveyors also recorded the following covariates at each station: sky condition, wind (Beaufort), temperature, time survey began, number of passing vehicles, and a code for noise effects.

All observers used the pre-recorded territorial call of a Red-shouldered Hawk available at <http://wiatri.net/projects/birdroutes/hawk.htm>. Equipment was standardized to produce an output of 100-110 db measured one meter from the caller/speaker. An example used by many surveyors included a SanDisk Sansa m230 mp3 player and RadioShack Mini Audio Amplifier (model 277-1008), a combination that is relatively inexpensive and portable yet effective.

For more details on the survey protocol, please see <http://wiatri.net/projects/birdroutes/Docs/RSHAprotocol2010.pdf>.

RESULTS and DISCUSSION

Survey Effort. Forty-one observers surveyed 42 of the 54 available routes statewide (Figure 1). Thirty-five routes were fully replicated twice, three routes had only partial data for one of two replicates, and four routes were surveyed only once for various reasons (weather, navigation problems, etc.). The median survey dates of 14 April and 28 April (Table 1) were slightly later than ideal due to last-minute planning for this pilot season.

Hawk Detections. Overall, observers detected 110 RSHAs at 84 unique stations across 23 different routes (Figure 1). These included 69 hawks from 41 surveyed routes during the first replicate and 41 hawks from 39 routes during the second replicate (Table 1). The most hawks found on a single survey were 17 on route #216, Lower Wisconsin River – Spring Green. For 35 routes with complete data from both replicates, detections per route generally decreased during the second replicate, though the difference was not statistically significant (paired two-sample t test, $p = 0.11$; Table 2).

Observers recorded 110 RSHA detections during 943 10-minute surveys (12%) at 84 of 504 survey stations (17%). This response rate doubles that found by King et al. (2007) during a similar but smaller-scale, citizen-based effort in central Wisconsin, where observers detected 60 RSHA responses on 987 surveys (6%) at 49 of 629 survey stations (8%). The difference is likely explained by the WBCI survey sampling prime bottomland hardwood forest habitat in western Wisconsin and more specifically identifying RSHA habitat elsewhere using advanced modeling techniques.

Distribution. Sixty-six of 110 RSHA detections (60%) occurred along river systems within the Driftless Area's Western Coulees & Ridges Ecological Landscape in west-southwest Wisconsin (Figure 1). Eleven of 23 routes with detections (48%) and 45 of 84 stations with detections (54%) also occurred here. The Lower Wisconsin (Richland, Sauk, Iowa Co.) and Black Rivers (La Crosse, Trempealeau Co.) were notable hotspots, collectively featuring 57 hawk detections at 36 unique stations from only six routes surveyed (Figure 1). Away from the Driftless Area,

observers found hawks at several Marinette County locations, on the Menominee Indian Reservation, along the Wolf River near Navarino State Wildlife Area, in the Kettle Moraine State Forest's Northern Unit, and scattered locations within the Central Sand Plains and Central Sand Hills ELs (Figure 1). At the edge of the species' range in north-northwest Wisconsin, detections occurred at only four unique stations on two routes. In general, where survey effort overlapped, distributional results were consistent with findings from the Wisconsin Breeding Bird Atlas (Jacobs 2006) and Natural Heritage Inventory database (Figure 1).

Other Results. Eighty-nine of 108 RSHA responses (82%) occurred within the first six minutes of the survey period during active playback (Figure 2). Mean and median distances of detection were 286 m and 200 m, respectively (range: 0-1000m), although these are likely biased low by observers' limited abilities to see and hear responding birds in forested habitats. Of 107 responses with data, 51 (48%) were heard only, 15 (14%) were sight only, and 41 (38%) were both auditory and visual. Other raptors detected during surveys (most incidentally, though some actively responding to RSHA playback) included 217 individuals of 9 species (Table 3).

Abundance Estimate. We used a binomial-Poisson mixture fit by Bayesian methods to estimate mean abundance of Red-shouldered Hawks per route (Royle and Dorazio 2008). This model also estimates and incorporates detection rate, or the proportion of hawks detected per route, using mark-recapture principles for data from both survey replicates for each route. The model assumes the detection rate, which acts as a correction factor for birds present but not detected on surveys, was the same for both replicates and all routes.

Model results estimated detection rate to be 0.45 (95% confidence interval: 0.28 – 0.61) and mean abundance as 3.12 hawks per route (95% CI: 2.09 – 4.84). If we make a realistic but untested assumption that each station along a route sampled hawks within 0.5 miles (~700 meters) of the survey point, then the total area surveyed by the route's 12 survey stations was 7.1 square miles. This equates (i.e. 3.12 hawks/7.1 mi²) to a coarse statewide density estimate of 0.44 RSHAs per square mile (or 1.0 per 2.3 mi²) of suitable habitat (95% CI: 0.29 – 0.68).

Future Work. The 2010 pilot survey was highly successful. Volunteer interest was high and their feedback indicated surveys were fun to partake in and straightforward to implement. We plan to conduct another statewide effort without significant changes in 2011. We will then re-assess the survey design and protocol to ensure that survey objectives are being met. This will, in part, include a power analysis to determine how many routes need to be surveyed over what time interval (i.e. every year, every 3 years, etc.) and a detailed habitat analysis to determine landscape, route, and point-level factors that influence occupancy by Red-shouldered Hawks, which will inform management decisions and allow for a more accurate statewide abundance estimate.

ACKNOWLEDGMENTS

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For more information on the Wisconsin Red-shouldered Hawk Survey, please see WBCI's bird monitoring website at <http://wiatri.net/projects/birdroutes/index.htm>.

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Table 1. Summary of results from the 2010 Wisconsin Red-shouldered Hawk Survey. Overall, observers tallied 110 Red-shouldered Hawk detections from 23 of the 42 routes surveyed statewide.

PARAMETER	SURVEY #1	SURVEY #2
# routes surveyed	41	39
# Red-shouldered Hawks	69	41
# RSHAs per route surveyed	1.7	1.1
# routes with RSHA	21	17
# RSHAs per route w/ RSHA	3.3	2.4
# routes = 0 RSHAs	20	22
# routes = 1 – 3 RSHAs	15	13
# routes = 4 – 9 RSHAs	5	4
# routes = 10+ RSHAs	1	0
Maximum # RSHAs	17 (Lower WI River)	8 (Black River)
Median survey date	14 April	28 April
Range of survey dates	2 April – 29 April	18 April – 18 May

Table 2. Comparison of Red-shouldered Hawk detections on 35 routes with two complete replicate surveys. The difference was not statistically significant ($p = 0.11$).

ROUTE #	ROUTE NAME	FIRST SURVEY	SECOND SURVEY	DIFF^a
129	Bass Lakes	4	1	-3
117	Wausaukee	3	0	-3
204	Lower WI River - Avoca	6	4	-2
252	Lower WI River - Muscoda	4	2	-2
107	Lake Arbutus	3	1	-2
110	Castle Rock Lake - East	3	1	-2
140	Barronett	2	0	-2
101	Niagara	4	3	-1
133	Amberg	3	2	-1
123	Merrillan	1	0	-1
3	Winter	2	2	0
137	Montello	1	1	0
240	Upper Miss River - Cassville	1	1	0
18 routes ^b	---	0	0	0
233	Black River - Melrose	1	2	1
282	Chippewa River - Meridean	0	1	1
109	Northern Kettle Moraine	1	3	2
205	Black River - North Bend	5	8	3
TOTAL	---	44	32	-12
MEAN	---	1.3	0.9	-0.3

^a Difference in detections between first and second replicate surveys

^b Eighteen routes detected no Red-shouldered Hawks on either survey

Table 3. Other raptors detected during the 2010 Wisconsin Red-shouldered Hawk Survey. Most of these were incidental observations not associated with RSHA playback.

Species	Total	Species	Total
Bald Eagle	125	Cooper's Hawk	4
Turkey Vulture	45	Barred Owl	3
Red-tailed Hawk	22	American Kestrel	2
Broad-winged Hawk	7	Osprey	2
Northern Harrier	7		

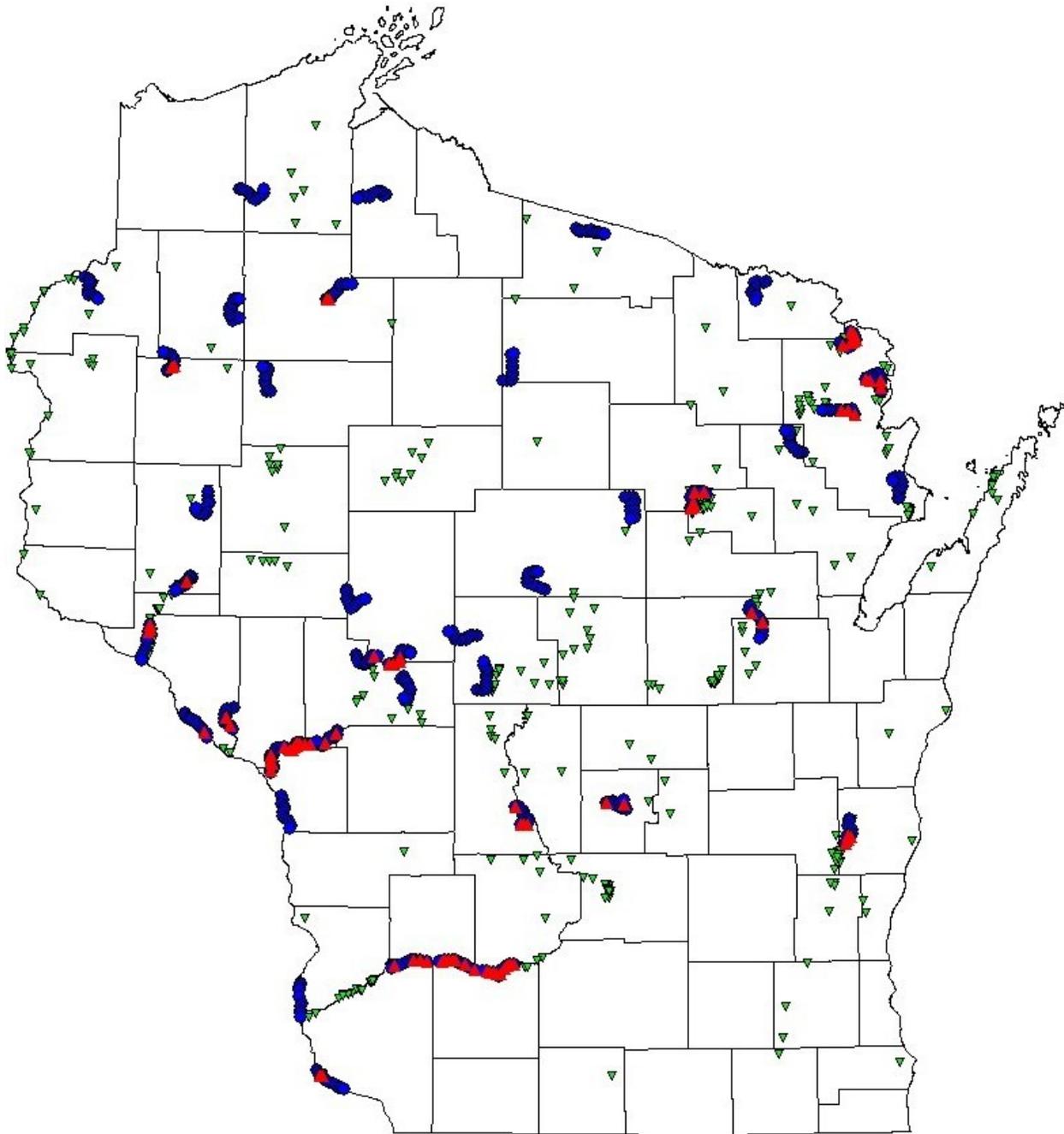


Figure 1. Locations of all 42 survey routes (blue circles) and 84 unique stations with RSHA detections (red triangles) during the 2010 Wisconsin Red-shouldered Hawk Survey. For comparison, inverted green triangles represent cumulative RSHA occurrences from the Natural Heritage Inventory program (NHI - <http://dnr.wi.gov/org/land/er/nhi/>).

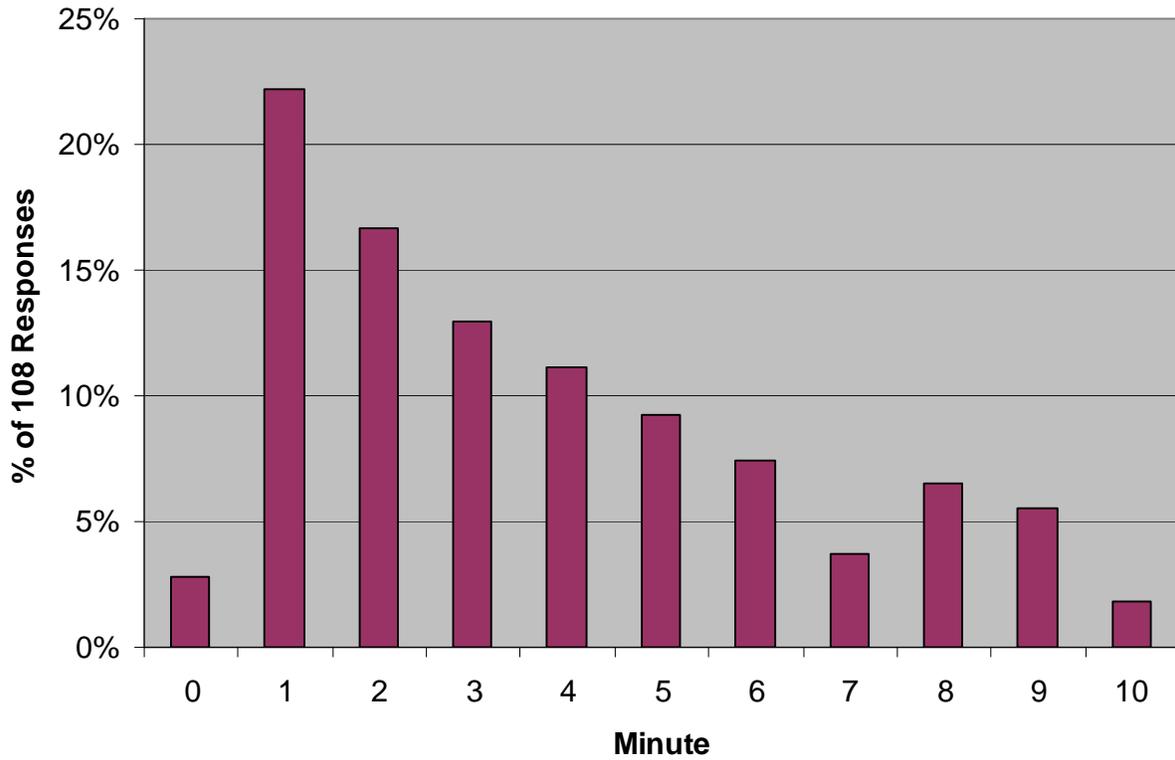


Figure 2. Time to first detection of 108 responses on the 2010 Wisconsin Red-shouldered Hawk Survey. Minute 0 indicates a hawk was detected at the station prior to the start of the 10-minute survey.