

Breeding Bird Monitoring in Western Great Lakes National Forests 1991-2007



Report to Chequamegon/Nicolet, Chippewa and Superior National Forests
April 09, 2008

Nicholas P. Danz, Annie Bracey, and Gerald J. Niemi

Natural Resources Research Institute
University of Minnesota Duluth
5013 Miller Trunk Highway
Duluth, MN 55811

This is NRRI Technical Report:
NRRI/TR-2008/11

Suggested citation:

Danz, N.P., A. Bracey, and G.J. Niemi. 2008. Breeding bird monitoring in Great Lakes National Forests 1991-2007. NRRI Technical Report NRRI/TR-2008/11, University of Minnesota, Duluth, MN.

SUMMARY

- A total of 129, 133, and 167 stands (1,254 survey points) were surveyed for breeding birds in the Chequamegon, Chippewa, and Superior National Forests (NF), respectively in 2007. Annual surveys have been conducted since 1991 in the Chippewa and Superior NF, and since 1992 in the Chequamegon NF.
- Comprehensive surveys of vegetation structure were carried out on 13 points on the Superior NF.
- Trends in relative abundance were calculated for 73 bird species, including 60 species in the Chequamegon NF, 57 in the Chippewa NF, and 49 in the Superior NF, for an overall total of 166 species*NF trends. Forty-one species were also tested for a pooled trend by combining data from the three national forests.
- Of the 166 species*NF trends, 72 (43%) were significant ($P \leq 0.05$). Thirty-two species increased significantly ($P \leq 0.05$) in at least one national forest and 21 species decreased. Thirteen species had significant increasing pooled trends and 7 had decreasing trends.
- Of the 163 species trends calculated in 2006, 28 (17%) changed in 2007. Twenty-five of the changes were positive, with 16 new increasing trends and 9 previously decreasing trends changed to stable. Fourteen of the changes were due to greater trend magnitudes on the Chequamegon NF.
- White-throated Sparrow, one of our most abundant ground nesting species, changed from a declining trend in Chippewa and Superior NFs to a stable trend. This species had a significantly decreasing trend in Chequamegon despite increased recent abundance.
- Ovenbird, our most abundant regional species, continued to show significant negative trends on three NFs, although it has been steadily increasing slightly since 2000.
- The percent of increasing species on each national forest ranged from 21% in the Chequamegon NF to 30% in the Superior NF. The percent of decreasing species ranged from 16% in the Superior NF, to 19% in the Chippewa NF.
- The short-distance migrant guild showed highly significant declines on the Chequamegon NF only; last year this guild decreased on all NFs. Long-distance migrants declined on all national forests in 2006 but only on the Chippewa NF in 2007. Permanent residents increased on the Chippewa and Superior NF and in the pooled NFs, but were stable on the Chequamegon NF.
- The ground nesting guild continued to show highly significant declines on all national forests. Shrub/sub-canopy nesters increased on all individual and pooled NFs. Canopy nesters increased in Superior NF and cavity-nesters increased in Chippewa and Superior NFs. All nesting guilds except canopy nesters showed significant trends in the pooled NFs with increases in shrub/subcanopy-nesters and cavity-nesters and decreases in ground-nesters.
- The coniferous forest guild increased on the Chippewa, Superior, and pooled NFs, while deciduous birds increased on the Chippewa but decreased on the Chequamegon. The mixed forest guild decreased on the Chequamegon and pooled NFs. Lowland birds decreased on both Chippewa and pooled NFs, while the early successional guild increased on the Chippewa NF only.

- Evidence from previous regional studies have demonstrated greater nest predation rates on ground nests near forest/clearcut edges, as well as a significant increase in the creation of forest edges in recent years. Increasing amounts of forest edge and nest predation may be having negative effects on declining ground-nesters such as the Winter Wren, Veery, Hermit Thrush, Ovenbird, and White-throated Sparrow.
- Of the 1274 survey sites on the three national forests, 16% have been at least partially harvested since the beginning of monitoring, which is about 1% a year. This harvest rate is comparable to the documented 4.8% change from mature forest to early-successional types on federally managed forest lands in northeastern Minnesota between 1990 and 1995 (i.e. ~1% annual change). Thus, it appears that management activities on our sample sites are representative of the national forests as a whole, and that the trends we are documenting are probably occurring across the regional landscape.
- Weighted overall trends for Management Indicator Habitats (MIH) in the Chequamegon were positive and between 0.5-0.75% annually for Mature Pine Forest, Pine Barrens, and Aspen Regeneration, but negative for Northern Hardwoods Interior Forest. Overall trends were positive on the Chippewa for all MIHs except MIH 9, Lowland black spruce – tamarack, which was due to the sharp declining trend of Connecticut Warbler. Trends for MIHs on the Superior NF had lower magnitude and were negative for MIHs 1-3 (Upland forest, Upland deciduous forest, and Northern hardwood and oak forest, respectively), but positive for MIHs 4,5,7,8, and 9 (Aspen-birch and mixed aspen-conifer forest, Upland conifer forest, Upland spruce-fir forest, Red and white pine forest, Jack pine forest, and Lowland black spruce-tamarack forest, respectively).
- Several of the declining trends that we have detected appear to be consistent across years instead of being due to a few years with very low or high abundance. One of the main goals of this monitoring program is to identify potential long-term declines of forest bird species, especially for species of conservation concern such as the Eastern Wood-Pewee, Winter Wren, and Hermit Thrush. The declines observed over the past years for these common species are a continuing concern and special management consideration may be given to them. The value of our long-term monitoring dataset increases with each year, evidenced by the reversal of trends for White-throated Sparrow and potentially Ovenbird, two species with apparently serious declines recently.
- In 2008, we will be adding approximately 75-100 new points in MIH 9: Lowland black spruce – tamarack on the Superior NF. This habitat is currently underrepresented in the sample on this forest.

INTRODUCTION

The national forests of the western Great Lakes have among the richest diversity of breeding bird species in North America (Green 1995, Rich et al. 2004). An increased appreciation of this diversity, along with concerns about potential declines of some species, has led to a strong interest in monitoring forest bird populations in the region. The relatively heavily forested landscapes of northern Minnesota and Wisconsin are considered to be population “sources” for many forest bird species and may be supplementing population “sinks” in the agricultural landscapes of the lower Midwest (Robinson et al. 1995, Temple and Flaspohler 1998), highlighting the importance of monitoring trends in forest bird populations in the upper Midwest.

Agencies such as the USDA Forest Service have a need for population trend data at the scale of an individual national forest to identify when and where population changes are occurring and to identify potential conservation problems. Large-scale population monitoring programs such

as the U.S. Geological Survey's Breeding Bird Survey (BBS) provide important information on trends at a continental scale. However, limited coverage in some areas can make it difficult to use BBS data to characterize population trends at smaller geographic scales (Peterjohn et al. 1995). Continental trends also have the potential to mask regional population trends (Holmes and Sherry 1988), thus there is a need for regional monitoring programs that can provide more localized information (Green 1995, Howe et al. 1997).

In response to the need for regional population data, a long-term forest breeding bird monitoring program was established in 1991 on the Chippewa and Superior National Forests, and in 1992 on the Chequamegon National Forest and the St. Croix region of east-central Minnesota. The Forest Service is mandated to monitor certain management indicator species (Manley 1993), and our monitoring program expands beyond indicator species to include all forest songbird species that we can adequately sample. Currently, 435 stands (1,271 points) within the three national forests are surveyed once during each breeding season (June 1 to July 10). From 1995 to 2001 we surveyed an additional 211 points in southeast Minnesota, however, counts were discontinued due to a lack of funding. See Lind et al. (2001b) for 1995-2001 results from southeast Minnesota. Surveys in the St. Croix region of east-central Minnesota were also discontinued after 2003 due to lack of funding, with 1992-2003 results available in our 2003 annual report (Lind et al. 2003). Results from the Nicolet National Forest bird monitoring program in northeastern Wisconsin were included in the 2005 analysis and a comparison with that forest is available in the 2005 annual report (Lind et al. 2005). In addition, species' range of natural variability (RNV, Hanowski and Danz 2003) have been calculated and compared to trends in 2004 and 2005 (Lind et al. 2004, 2005).

The primary objective of this report is to update U.S. Forest Service personnel on results of the forest bird monitoring program. We focus on relative abundance trends of individual species, as well as assemblages of species, over the 16 to 17 year time frame of the monitoring. Our intent is to summarize the most important results and to provide detailed information in appendix form for those who need more specific results. This report, as well as annual update reports from 1998 to 2006, can be found on the internet at: <http://www.nrri.umn.edu/mnbirds/reports.htm>. Other objectives, including bird/habitat and bird/landscape relationships, development of management recommendations for birds, and development and monitoring of the forest plan, were met through Minnesota's Forest Bird Diversity Initiative (Niemi et al. 2003). Additional information on these objectives will be available as time and monetary resources become available.

DESIGN AND METHODS

Sample Design

The monitoring program was designed to provide an accurate estimate of population change for forest bird species on three national forests in northern Minnesota and Wisconsin (Figure 1). The spatial extent of each national forest is large, on the order of hundreds of thousands of hectares, and each area includes a mosaic of forest stand types. We distributed sampling locations across the forest mosaic in a stratified random manner. A list of forest stands was created for each study area, and stands

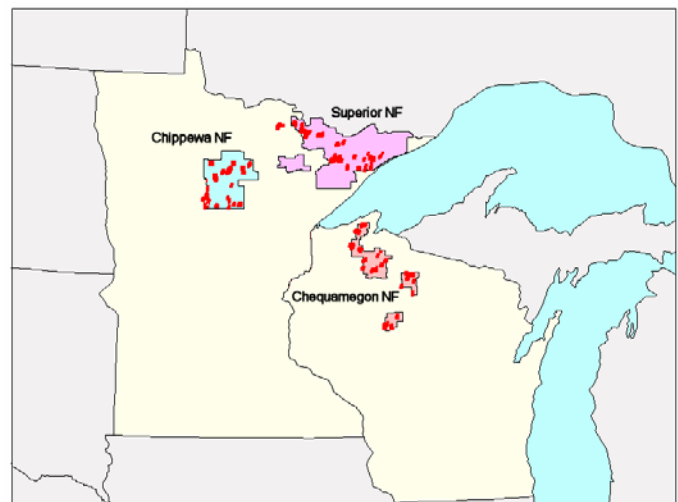


Figure 1. Locations of forest breeding bird point counts in northern Minnesota and Wisconsin 1991-2007.

with the same stand type according to dominant tree species and stocking density were grouped into strata. Stands were ≥ 16 ha (40 acres) and were identified from the individual national forest inventories. For each national forest, a number of stands were selected from each stratum so that the final proportion of stands of each stand type was equal to the proportion of forested land area of each stand type (Hanowski and Niemi 1995). Our sample of stands is therefore representative of the forest cover in each national forest. A total of 133, 135, and 169 stands were established in the Chequamegon, Chippewa, and Superior National Forests, respectively.

Stands were large enough to accommodate three sampling points a minimum of 220 meters apart. Changes to forest cover through natural and anthropogenic disturbance have occurred on sampling locations since the beginning of the study and may have caused concomitant changes in bird populations. Because sampling locations are permanently marked, we are able to incorporate such changes into our descriptions of bird population patterns through time.

Sampling

Point count sampling used in our program follow national and regional standards (Ralph et al. 1993, 1995, Howe et al. 1997). Ten-minute point counts were conducted at each point between June and early July (Reynolds et al. 1980). Point counts are appropriate for determining the relative abundance of most singing passerine species, but are inadequate for waterfowl, grouse, woodpeckers, and most raptors. In addition, because our surveys are conducted during the summer months, we may underestimate the relative abundance of early-nesting species (e.g. permanent residents that begin breeding in April, such as woodpeckers and chickadees).

Point counts were conducted by trained observers (see observer training section below) from approximately 0.5 hour before to 4 hours after sunrise on days with little wind (< 15 km/hr) and little or no precipitation. All birds heard or seen from the point were recorded with estimates of their distance from that point. From 1991 to 1994, all birds heard or seen within 100 m of the point were recorded. From 1995-2006, we included all birds heard or seen from the point regardless of distance so that our results could be compared with other monitoring programs in this region (see Howe et al. 1997). The number of individuals observed for each species can be summed for 3, 5, and 10-minute periods so that regional comparisons are possible with data gathered using 3 or 5-minute point counts.

We attempted to have each observer sample a similar number of stands of each forest cover type. This was done to minimize bias due to observer differences in sampling different forest cover types. Weather data (cloud cover, temperature, and wind speed) and time of day were recorded before each count.

Observer Training

Prior to the field season, tapes of 120+ bird songs were provided as a learning tool, and all observers were required to pass an identification test of 75 bird songs made by Cornell University's Laboratory of Ornithology. A standard for number of correct responses was established by giving the test to observers who were trained in identifying birds by sound, and who had four to five years of field experience. This was done to identify songs on the tape that were not good representations of songs heard in northern Minnesota and Wisconsin. Based on results of trained observers, the standard for passing was set at 85% correct responses. Songs on the tape were grouped by habitat (e.g., upland deciduous, lowland coniferous) to simulate field cues that would aid in song identification.

Observer field training was conducted during the last week of May in the Superior National Forest. Observers conducted simultaneous practice counts at several points used in the monitoring program. Data were compiled for each observer, and species lists and numbers of

individuals recorded on the count by each observer were compared to that of experienced observers. Deviations from the average or species missed were noted on the field sheets and returned. In addition to field training and testing, all observers were required to have a hearing test to ensure that their hearing was within normal ranges, as established by audiologists, for all frequencies (125 to 8000 hertz).

Analysis

The pattern of population change through time can be viewed in two distinct ways: 1) as *population trajectory*, the path of a population through time, including its ups and downs, and 2) as *population trend*, the overall pattern of increase or decrease over the course of the study, presented as a positive or negative number. We built statistical models of species relative abundance as a function of time to describe these features of bird populations.

Relative abundance

For each species, yearly relative abundance was calculated using birds detected within 100 m of each point. Relative abundance for species from the three national forests was calculated by summing the number of individuals of each species across two points per stand. In order to avoid double-counting of individuals, data from the two farthest separated points within a stand were summed and analyzed.

We used a set of criteria to ensure that our analyses provided reliable population information. Stands were included in the analysis only if they had been sampled in at least six years. Data were included for a species if it was observed on a minimum of five stands per study area and in at least three years on each stand. For species that were observed on a minimum of five stands in each of the three national forests, we pooled all stands and carried out an additional (three national forest combined) analysis. Although this pooled analysis does not include lands in non-federal ownerships, it should give an indication of population trends at a larger scale than the individual national forest.

Population trajectory

Population trajectory can be thought of simply as the size of a population across time. Because we do not record every individual bird present in our study areas, we cannot know true population size. Instead, we must rely on our sample design to give an index of population size in each year. Central to our analytical process is how we scaled up bird abundance recorded at the stand level to an annual index of population size for the study areas. We used a non-parametric route regression procedure similar to that described by James et al. (1996), in which observed abundances on each stand are smoothed and then combined to give a region-wide index of population size.

We used locally-weighted (LOESS) regression to smooth the time series of species relative abundance for each stand. In LOESS-regression, fitted values (points along the curve) for years are calculated by giving a small amount of weight to neighboring years, for example, a year with high raw abundance for a species would tend to bring up the fitted values for the year before and the year after. We then computed the arithmetic mean and 95% confidence intervals using the fitted values from the within-stand regressions for each species in each year. The mean fitted value represents the annual index of population size. By plotting the mean fitted values and confidence intervals in a time series, we get a graphic depiction of the population trajectory (Appendix A). With every new year of sampling, we can expect the modeled abundance of a species in a given year to vary slightly from previous years' results, due to the way fitted abundance values are calculated in the LOESS-regression.

Population trend

Population trend can be thought of as a statement of the direction and magnitude of population change over a given time period (Link and Sauer 1997). Because a significant trend implies a unidirectional change, linear methods can be used to detect trend without asserting that the population trajectory is linear (Urquhart and Kincaid 1999). To assess trend, we modeled the relationship between the annual index of population size for a study area (described in *Population Trajectory* above) and time using simple linear regression. We used the slope coefficient to characterize direction and magnitude of the trend. To facilitate comparison, slopes were converted to units of % annual change by dividing annual population indexes by the predicted value of the index at the midpoint of the survey period prior to regressing the index against time (Bart et al. 2003). We assessed the significance of the regressions using a bootstrap procedure (Manly 1990) in which trends were computed for 500 bootstrap resamples of the stands used to calculate the annual population index. For each bootstrap resample, trend was calculated using the same steps as for the original trend. For each original trend, an exact p-value was calculated as the percentile at which zero occurred in the distribution of 500 bootstrapped slopes. For example, $p = 0.01$ would be equivalent to 99% of bootstrapped slopes being greater than zero, which would give us a high degree of confidence that the true population slope was different from zero.

Guild Analyses

We examined trends for three types of guilds: migration strategy, nesting substrate, and vegetation-type preference (Appendix C). Guild analyses followed similar procedures as the individual species analyses, except that each species was assigned a guild category and all species within that category (e.g. long-distance migrants) were combined and analyzed as a group. All non-flyover individuals of all species within the 100 m radius were included, regardless of whether the species met the inclusion criteria described above for individual species. Guild categories were taken from Erlich et al. (1988) and Freemark and Collins (1992), with modifications based on personal experience and data from the region.

Note that some species use different migration strategies, nesting substrates, and vegetation types in different portions of their geographic range. Guild analyses also can be complicated by a lack of agreement on how to categorize guilds, and there will always be species that use multiple guilds. Species guilds are not mutually exclusive and the species pool in a migration guild, for example, can be very similar to the species pool in a nesting guild (Sauer et al. 1996). Directional trends in abundant species can strongly affect all the guilds that those species are categorized in. Given these limitations, we still feel it is important to look for underlying similarities among groups of increasing and decreasing species.

Vegetation Sampling

Since the beginning of the monitoring program in 1991, we have carried out vegetation surveys on bird point count locations using ocular estimates of overstory, shrub, and understory characteristics. We have used a protocol designed to maximize time-efficiency, with each survey taking fewer than 5 minutes to carry out. Every point was surveyed at least once in the early-mid 1990s and again in 2005-2006. It has always been our goal to obtain more comprehensive, standardized measurements of vegetation on the point count locations for the purpose of developing bird/habitat relationships. In 2006, we developed a more detailed vegetation sampling protocol based on measured variables that would be useful to forest managers instead of ocular estimates alone. In 2007, we surveyed 220 points and in 2007 an additional 13 were surveyed by the Superior NF monitoring personnel.

RESULTS AND DISCUSSION

Over the course of 17 field seasons we have detected over 327,000 individual birds of 173 species on more than 21,000 ten-minute point counts (almost 3,500 hours of sampling) in the three national forests (Figure 2). In 2007, we sampled 129 stands in the Chequamegon NF, 133 stands in the Chippewa NF, and 167 in the Superior NF.

Seventy-three species were tested for trends in at least one national forest, including 60 in the Chequamegon NF, 57 in the Chippewa NF, and 49 in the Superior NF (Table 1).

Additionally, 41 species were tested for a “pooled” (three national forests combined) trend. As monitoring has proceeded through the years, new species

have met our criteria for inclusion in trend analyses on each national forest. The number of tested species has increased steadily from 36 in 2000, when the criteria were first applied, to 73 in 2007. See Appendix A for graphs of individual species trajectories and Appendix B for test statistics and sample sizes used in the trend analyses.

The number of tested species has increased steadily from 36 in 2000, when the criteria were first applied, to 73 in 2007. See Appendix A for graphs of individual species trajectories and Appendix B for test statistics and sample sizes used in the trend analyses.

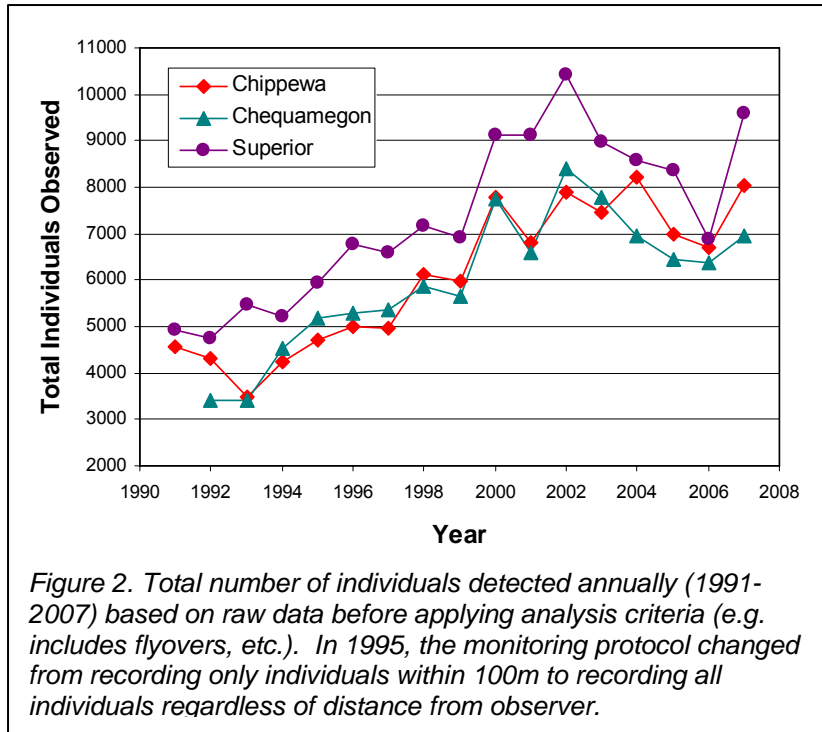


Figure 2. Total number of individuals detected annually (1991-2007) based on raw data before applying analysis criteria (e.g. includes flyovers, etc.). In 1995, the monitoring protocol changed from recording only individuals within 100m to recording all individuals regardless of distance from observer.

Overview of Population Trends

A total of 166 species/national forest trends were calculated (not including pooled trends), 72 (43%) of which were significant ($P \leq 0.05$). Thirty-two species increased in at least one national forest, including eight (Hairy Woodpecker, Yellow-bellied Flycatcher, Red-eyed Vireo, Black-capped Chickadee, Red-breasted Nuthatch, Cedar Waxwing, Chestnut-sided Warbler, and American Redstart) that increased in multiple national forests (Tables 2 and 3). Twenty one species decreased in at least one national forest, including seven (Eastern Wood-Pewee, Great-crested Flycatcher, Winter Wren, Veery, Hermit Thrush, Ovenbird, and Scarlet Tanager) that decreased in multiple national forests (Tables 4 and 5).

Of the 163 species/national forest trends calculated in 2006 (i.e., excluding pooled

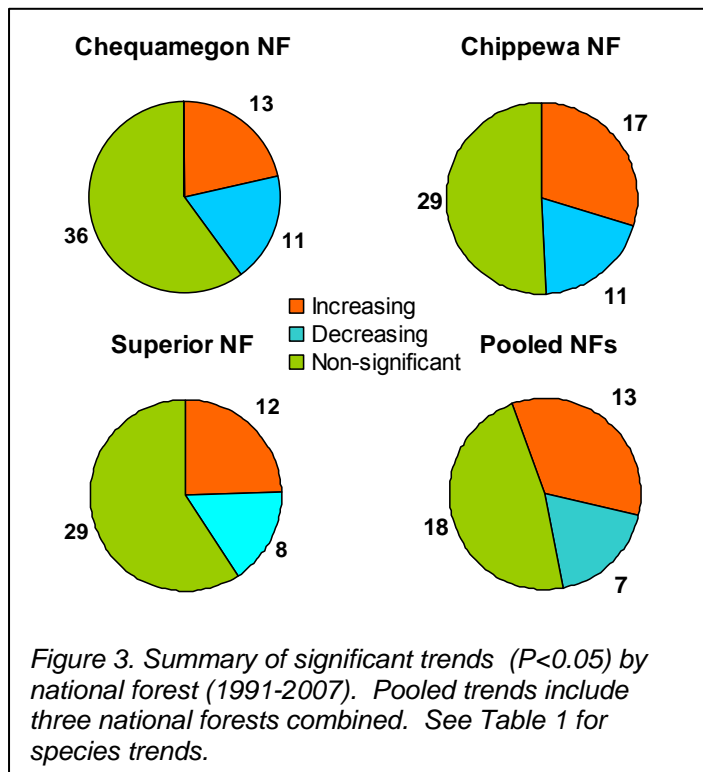


Figure 3. Summary of significant trends ($P < 0.05$) by national forest (1991-2007). Pooled trends include three national forests combined. See Table 1 for species trends.

trends, Etterson et al. 2007), 28 (17%) changed in 2007 (Table 6). Twenty-five of the changes were positive, with 16 new increasing trends and 9 previously decreasing trends changed to stable. Fourteen of the changes were due to greater trend magnitudes on the Chequamegon NF.

Many of the species we monitor exhibit large annual fluctuations in abundance, a phenomenon which has been documented on several other long-term studies (Virkkala 1991, Blake et al. 1994, Weslowski and Tomialojc 1997, Holmes and Sherry 2001). Long-term monitoring studies are important for differentiating between these short-term fluctuations and actual long-term trends. In previous years' results, we often saw species with opposite trends in different study areas (e.g. five species in 2000 results; Lind et al. 2001a). After 17 years of sampling, there now appears to be “core” groups of consistently increasing species (e.g. Red-eyed Vireo, Black-capped Chickadee, American Redstart) and decreasing species (e.g. Eastern Wood-Pewee, Winter Wren, Veery, Hermit Thrush, and Ovenbird).

Chequamegon National Forest

We observed 6813 individuals of 104 species overall on the Chequamegon NF in 2007. This was the fourth highest total number of individuals and three species less than the highest observed annual richness of 107 in 1999. Forty-four species did not meet the criteria to be included in trend analysis (Appendix D). Notable among these were five species with all-time high observation totals (in parentheses), including Wild Turkey (10), Ruby-throated Hummingbird (23), Pileated Woodpecker (31), Gray Catbird (24), and Pine Siskin (28). Black-billed Cuckoo was observed 19 times, the second highest total since monitoring began.

Number of observations on Chequamegon NF for 10 most abundant species in 2007.

<i>Species</i>	<i>Count</i>
<i>Ovenbird</i>	1003
<i>Red-eyed Vireo</i>	823
<i>Black-throated Green Warbler</i>	254
<i>Nashville Warbler</i>	240
<i>Blue Jay</i>	222
<i>Chestnut-sided Warbler</i>	211
<i>Rose-breasted Grosbeak</i>	208
<i>White-throated Sparrow</i>	180
<i>Hermit Thrush</i>	175
<i>American Robin</i>	156

Of the 60 species tested for trends in the Chequamegon NF, 13 species (22%) increased significantly and 11 (18%) have decreased (Figure 3). Compared to 2006, there were eight new increasing species and five fewer decreasing species. Northern Waterthrush was increasing in 2006 but is now stable. Yellow Warbler and Purple Finch had the greatest rates of increase (>10%), but neither species is widespread in the forest (detected on <=7 stands). Indigo Bunting, American Redstart, and Red-breasted Nuthatch are fairly widespread species with trends >5%.

The Eastern Wood-Pewee, Winter Wren, and Hermit Thrush are well-represented on the Chequamegon NF, but have some of the greatest declines (5-9% annually; Appendix B). Great-crested Flycatcher and Blue-headed Vireo are less widespread on the forest (28 and 22 stands, respectively) and are also experiencing 5% declines. The Red-winged Blackbird and Evening Grosbeak have the highest rates of decrease, but they are each tested on just six stands and their trends may be more susceptible to site-specific influences than other species. Both of these species are, however, showing substantial declines in other parts of their ranges (Sauer 2004). Other common species in Chequamegon NF that are declining, though at a lesser rate, include Veery, Brown Thrasher, Yellow-rumped Warbler, Black-throated Green Warbler, and Ovenbird.

Chippewa National Forest

We observed the second-highest total of 7815 individuals of 103 species overall on the Chippewa NF in 2007. Red-eyed Vireo and Ovenbird were the two most abundant species. Forty-six species did not meet the inclusion criteria for trend analysis. Notable among these species were House Wren (8), Eastern Towhee (12), Vesper Sparrow (8), Black-backed Woodpecker (13), and Ruby-throated Hummingbird (15), all of which had their highest observation totals since monitoring began (in parentheses) (Appendix E).

Of the 57 species tested in the Chippewa NF, 17 species (30%) increased significantly and 11 (19%) decreased (Figure 3). Canada Warbler and American Goldfinch had the greatest rates of increase (>10% annually), but are found on 15 or fewer stands. Cedar Waxwing and Wood Thrush continued to increase rapidly (7%) and were moderately widespread. Several widespread species, including Black-capped Chickadee, Red-breasted Nuthatch, White-breasted Nuthatch, and Black-and-white Warbler had >5% annual increases.

Black-throated Green Warbler, Yellow-bellied Flycatcher, Least Flycatcher, and Veery showed new increases in 2007. Gray Catbird reversed back to a stable trend after changing back-and-forth from increasing in the past several years. Gray Catbird was formerly increasing but is now stable, while Purple Finch and White-throated Sparrow were decreasing in 2006 but are now stable (Table 6).

The greatest rate of annual decrease in the Chippewa NF is that of the Connecticut Warbler (-13%). Although it is sampled on only 14 stands, the species has declined consistently since 1991 and the stands on which it occurs are spread across most of the forest. Well-represented species (detected on >= 40 stands) that are showing annual rates of decline of 3% or more include the Eastern Wood-Pewee, Winter Wren, Hermit Thrush, and Song Sparrow. Great Crested Flycatcher and Scarlet Tanager, two moderately widespread species (>25 stands) continue to decline. Ovenbird is declining at 2%/year, but its trend may be especially important given its widespread distribution.

Number of observations on Chippewa NF for 10 most abundant species in 2007.

<i>Species</i>	<i>Count</i>
<i>Red-eyed Vireo</i>	997
<i>Ovenbird</i>	835
<i>Veery</i>	402
<i>White-throated Sparrow</i>	387
<i>Least Flycatcher</i>	368
<i>Nashville Warbler</i>	348
<i>Chestnut-sided Warbler</i>	330
<i>American Redstart</i>	260
<i>Hermit Thrush</i>	249
<i>Pine Warbler</i>	215

Superior National Forest

We observed 9359 individuals and 93 species on the Superior NF in 2007. This was the second greatest annual number of individuals since monitoring began in 1991. Forty-four species were observed that did not meet the minimum abundance criteria for trends. Notable among these species were Black-billed Cuckoo (47), Ruby-throated Hummingbird (10), Black-backed Woodpecker (8), Red Crossbill (21), and Pine Siskin (41), all of which had all-time high observation records (in parentheses) (Appendix F). Additionally, one Boreal Owl was observed.

Of the 49 species tested in the Superior NF, 12 species (24%) were increasing and 8 (16%) were decreasing (Figure 3). Black-throated Blue Warbler and Hairy

Number of observations on Superior NF for 10 most abundant species in 2007.

<i>Species</i>	<i>Count</i>
<i>Ovenbird</i>	1168
<i>White-throated Sparrow</i>	940
<i>Nashville Warbler</i>	867
<i>Red-eyed Vireo</i>	771
<i>Chestnut-sided Warbler</i>	375
<i>Magnolia Warbler</i>	282
<i>Hermit Thrush</i>	265
<i>Veery</i>	264
<i>Mourning Warbler</i>	257
<i>Blue Jay</i>	230

Woodpecker have rates of increase >9%, but they were tested on 11 or fewer stands and their trends may be more susceptible to site-specific influences than other species. Northern Flicker, Black-capped Chickadee, Red-breasted Nuthatch, Golden-crowned Kinglet, and Cedar Waxwing are widespread species increasing at >5% annually.

Compared to 2006, Nashville Warbler and Brown Creeper are now significantly increasing. Mourning Warbler and White-throated Sparrow were formerly declining but are now stable. American Redstart is the only species with a significantly negative change to its trend, now being stable after increasing in 2006 (Table 6).

Tennessee Warbler, Scarlet Tanager and Eastern Wood-Pewee have the greatest rates of decrease (-16%, -9%, and -6% annually), but are not widespread species in Superior NF. Rose-breasted Grosbeak, Winter Wren, and Veery, are declining at >3% annually, and are widely distributed on the forest. Ovenbird, the most abundant species on the Superior NF, continues to show a 1% population decline.

Pooled National Forests

Of the 41 species tested for a pooled national forests trend, 13 species (32%) increased significantly and 11 (17%) decreased (Figure 3). The strongest increases (>3%/year) across all national forests occurred in Hairy Woodpecker, Black-capped Chickadee, Red-breasted Nuthatch, Golden-crowned Kinglet, Cedar Waxwing, Magnolia Warbler, and American Redstart. Other widespread species that increased include Yellow-bellied Flycatcher, Red-eyed Vireo, Northern Parula, Chestnut-sided Warbler, Blackburnian Warbler, and Black-and-white Warbler. Of these species, increases in Cedar Waxwing and Blackburnian Warbler were new in 2006. All species that were increasing in 2006 in the pooled analysis were again increasing in 2007 (Table 6).

The strongest decreases across all national forests occurred in Eastern Wood-Pewee, Winter Wren, Hermit Thrush, and Scarlet Tanager (>3%/year). Other widespread species that declined include Veery, Ovenbird, and Common Yellowthroat. No species show new declining trends in the pooled analysis in 2006. Four species – Yellow-rumped Warbler, Mourning Warbler, Song Sparrow, and White-throated Sparrow – were formerly declining species that now have stable trends (Table 6).

Management Activities on Study Areas

Of the 1274 survey sites on the three national forests, 16% have been at least partially harvested since the beginning of monitoring, which is about 1% a year. A small number of our monitoring points have also had prescribed burns since the start of monitoring, but this is usually done after harvest. This harvest rate is comparable to the 4.8% change from mature forest to early-successional types on federally managed forest lands in northeastern Minnesota between 1990 and 1995 (i.e. ~1% annual change; Wolter and White 2002). Thus, it appears that management activities on our sample sites are representative of the national forests as a whole, and that the trends we are documenting are probably occurring across the regional landscape.

Guild Analyses

Short-distance migrants (species that winter mainly north of Mexico) showed highly significant declines in all three national forests in 2006, but were declining significantly in the Chequamegon NF only in 2007 (Table 7). The most abundant short-distance migrants in our analyses include White-throated Sparrow, American Robin, Hermit Thrush, and Yellow-rumped Warbler, species which had increased abundances in 2007. Long-distance migrants (species that winter mainly south of the U.S./Mexico border) did not decline significantly in any forest in

2007 but did increase on the Chippewa, which was a change from 2006 when this guild declined significantly in each forest. Abundant long-distance migrants included Ovenbird, Red-eyed Vireo, Nashville Warbler, and Chestnut-sided Warbler. Permanent residents increased significantly in all forests except the Chequamegon NF, where they showed non-significant declines. Black-capped Chickadee, Blue Jay, and Red-breasted and White-breasted nuthatches are the most abundant permanent residents.

Ground nesting birds continued to show highly significant declines in all study areas, while shrub/sub-canopy nesters significantly increased in all study areas (Table 7). Abundant ground-nesters include Ovenbird, Nashville Warbler, Veery, and White-throated Sparrow. The most common shrub and subcanopy-nesting species include Red-eyed Vireo, Chestnut-sided Warbler, and American Redstart. Canopy nesters increased significantly in Superior NF (Table 7) and cavity nesters showed highly significant increases in the Superior NF and the pooled analysis (Table 7). Most primary cavity excavators (e.g. woodpeckers) have had stable trends, while many secondary excavators (e.g. chickadees and nuthatches) have had increasing trends. An exception is the Great Crested Flycatcher (a secondary excavator) which is declining in the Chequamegon and Chippewa NF.

The habitat guilds had varying patterns of increase and decrease. The coniferous forest guild increased on the Chippewa, Superior, and pooled NFs, while deciduous birds increased on the Chippewa but increased on the Chequamegon. The mixed forest guild decreased on the Chequamegon and pooled NFs. Lowland birds decreased on both Chippewa and pooled NFs, while the early successional guild increased on the Chippewa NF only.

Management Indicator Habitats

To some degree, changes in bird populations are representative of changes in their preferred habitat. One way to judge the quality or quantity of Management Indicator Habitats for birds is to evaluate whether species with greater affinity for these habitats tend to be increasing or decreasing. If MIHs are improving or becoming more abundant, this should be reflected by positive trends in birds that prefer these habitats. To judge the overall pattern of bird species population change in MIHs, we computed a weighted mean of all trends for each MIH, giving greater weight to trends for species with greater affinity for the MIH. Weights were calculations from Indicator Value (IV) analysis (Dufrene and Legendre, 1997), which combines the frequency of occurrence of species in a habitat with the mean abundance of species in a habitat. Larger Indicator Values indicate greater affinity for a habitat. For example, in the Aspen Regeneration MIH on the Chequamegon NF, the trend for Chestnut-sided Warbler received the greatest weight (IV = 23), while Brown Creeper received the lowest weight (IV = 0.01). Thus, if several species with high affinity for a MIH are increasing, the overall mean trend for the MIH is likely to be positive. Conversely, if many species with high affinity for an MIH are declining, the overall trend is likely to be negative. Some MIHs in the Chippewa and Superior NFs were excluded due to insufficient sample points: MIH 6-Upland spruce-fir forest, MIH 10-Upland mature riparian forest, MIH 11-Management-induced Edge Density Upland forest & Lowland forest, MIH 11 - Upland Interior forest habitat, and MIH 12-Large patches of upland mature/old forest. Additionally, only mature stands (i.e. pole- and sawtimber) in our surveys were used for MIH analyses.

On the Chequamegon NF, the weighted mean trend estimates were positive for all MIHs except Mature Northern Hardwood Interior Forest, indicating that these habitats are sustaining, on average, species that have an affinity for them. Increasing trends of Chestnut-sided Warbler, and to a lesser extent, Rose-breasted Grosbeak and American Redstart, were primarily responsible for the positive trend in Aspen Regeneration. The 0.5% annual decline in Mature Northern Hardwood Interior Forest was driven in large part by declines of Ovenbird, Eastern Wood-Pewee, Least Flycatcher, Black-throated Green Warbler, and Scarlet Tanager, all species with decreasing trends and high affinity for this MIH. Sharp increases paired with high affinity for Pine Barrens for both Vesper Sparrow and Eastern Towhee resulted in a positive trend for this MIH, offsetting a steep declining trend for Brown Thrasher. Positive trends for Canada Warbler were the primary influence on the estimate for Mature Pine Forest despite negative trends by Veery, Hermit Thrush, and Evening Grosbeak, which were declining in this habitat type.

Weighted mean trend estimates for Chequamegon NF MIHs.

<i>Management Indicator Habitat</i>	<i>Weighted Mean Trend (%)</i>
<i>Aspen Regeneration</i>	<i>0.69</i>
<i>Mature Northern Hardwood Interior Forest</i>	<i>-0.49</i>
<i>Mature Pine Forest</i>	<i>0.71</i>
<i>Pine Barrens</i>	<i>0.54</i>

Mean trends were generally greater in absolute terms (range 0.6 – 1.7% annually) for the Chippewa compared to the other two forests. Trends were also likely to be positive, with only MIH 9, Lowland black spruce-tamarack forest, having a declining trend. For MIH 9, the overall decline was driven exclusively by Connecticut Warbler, a species with a high affinity for this habitat (Indicator Value = 27) and a sharply declining trend (-13%). Removing this species from the analysis for MIH 9 improved the weighted trend to +0.6%. For MIHs 2, 7, and 8, Chestnut-sided Warbler had an important positive influence on the weighted mean, while Canada Warbler had an important positive influence for MIHs 1, 7, and 4. Ovenbird and Eastern Wood-Pewee had significant negative influences on MIHs 1,2,3,5,7, and 8 despite the overall trend in these MIHs being positive.

Weighted mean trend estimates for Chippewa and Superior NF MIHs.

<i>Management Indicator Habitat</i>	<i>Weighted Mean Trend (%)</i>	
	<i>Chippewa</i>	<i>Superior</i>
<i>1. Upland forest</i>	<i>1.04</i>	<i>-0.16</i>
<i>2. Upland deciduous forest</i>	<i>1.03</i>	<i>-0.47</i>
<i>3. Northern hardwood and oak forest</i>	<i>0.63</i>	<i>-0.62</i>
<i>4. Aspen-birch and mixed aspen-conifer forest</i>	<i>1.72</i>	<i>0.09</i>
<i>5. Upland conifer forest</i>	<i>0.73</i>	<i>0.29</i>
<i>7. Red and white pine forest</i>	<i>1.16</i>	<i>0.17</i>
<i>8. Jack pine forest</i>	<i>0.94</i>	<i>0.39</i>
<i>9. Lowland black spruce-tamarack forest</i>	<i>-1.58</i>	<i>0.58</i>

On the Superior NF, mean weighted trends had the lowest absolute values across the three forests, ranging from 0.09 - 0.62% per year. Declining trends paired with high Indicator Values for

Scarlet Tanager, Veery, and Eastern Wood-Pewee gave the greatest weight to negative trends in MIHs 1-3. This was balanced to some degree by increases in Black-capped Chickadee and Red-eyed Vireo in these habitats. In MIHs 4 and 9, Golden-crowned Kinglet had the greatest influence on the overall positive trend. Upland MIHs 5 and 7 with a significant pine component were positively buoyed by Pine Warbler and Red-breasted Nuthatch but negatively by Eastern Wood-Pewee.

CONCLUSIONS

This year was marked by the trends of many species becoming more positive. For example, 25 of 28 trends that were significantly different from last year (i.e. from a significant trend to a non-significant one or vice-versa) changed in a positive direction. Zero species had new declining trends in 2007 and only three species changed from increasing to stable trends. Most of the species with widespread increasing trends are either forest habitat generalists (e.g. Red-eyed Vireo, Black-capped Chickadee and Blue Jay) or early successional species (e.g. Cedar Waxwing, Chestnut-sided Warbler and American Redstart). Many of these increasing species are currently at or above their estimated population size range of natural variability (RNV) values (Lind et al. 2005). Recent increases in the amount of edge and early-successional habitat on the regional landscape (Wolter and White 2002) may be benefiting these species. Black-capped Chickadee, Red-breasted Nuthatch, and Hairy Woodpecker are year-round residents that may also be responding to increased food availability from bird feeding activities, especially considering their increasing numbers on Minnesota Christmas Bird Counts in the past decade (Niemi et al. 1996, National Audubon Society 2004).

The White-throated Sparrow was experiencing alarming declines on all three NFs as of 2000, but this species recently has been on the rise throughout the region and has converted to a stable trend in the Chippewa and Superior NFs in 2007. While the trend continues to be significantly negative in the Chequamegon NF, it appears this trend is influenced by three high-abundance years in the beginning of the study. If the Chequamegon population continues on its trajectory, it may switch to a stable trend soon.

Species with widespread declines on our study sites are mainly found in mature forest habitats, with the possible exception of Veery. The Eastern Wood-Pewee, Winter Wren, and Veery, have each shown significant declines on our surveys as well as USGS Breeding Bird Survey routes over much of their range (Sauer 2004). Increases in edge and early-successional habitats may be having negative effects on these species, although there are examples of increases in mature forest species on individual national forests (e.g., White-breasted Nuthatch, Black-throated Blue Warbler, Northern Waterthrush). There are also examples of decreases in shrub/early successional species (Mourning Warbler, Common Yellowthroat). Connecticut Warbler, a species with a high affinity for lowland conifer, continued its consistent decline on the Chippewa NF, with the population down over 200% (-13% annual change) since the survey began. This species is stable on regional trends estimated from the US Breeding Bird Survey, however.

The declines in ground nesters and increases in shrub nesters in our study seem to occur irrespective of migration strategy and habitat. It is possible that declines in ground-nesting populations are being influenced by recent changes in the landscapes of the Upper Midwest. Although the landscape surrounding the three national forests is primarily forested, average forest stand sizes and ages have changed in recent years. Wolter and White (2002) demonstrated a substantial decrease in patch size and interior forest area and a significant increase in edge density in early successional forest types in northeastern Minnesota between 1990 and 1995. Studies have shown that nesting success is reduced in landscapes with reduced patch sizes and high amounts of edge habitat, probably due to an increase in generalist nest predators (Robinson et al. 1995, Hanski et al. 1996, Donovan et al. 1997). In the forested landscapes of the upper Midwest, recent studies have found higher predation rates on ground nests near forest/clearcut edges than in interior areas (Fenske-Crawford and Niemi 1997, Manolis et al. 2000, Flaspohler et al. 2001). Data from the Minnesota DNR winter track survey (Berg 2001) between 1991 and 2000 indicate a peak in track indices in 1995 for potential ground nest predators such as fisher (*Martes pennati*) and pine marten (*Martes martes*), which

loosely follows the declines between 1994 and 1996 in many of the species we monitor. Nonetheless, the effects of nest predation on population trends in this study are unknown.

One of the main goals of this monitoring program is to identify consistent long-term declines of forest bird species. This is especially true for species of conservation concern such as the Eastern Wood-Pewee, Winter Wren, Hermit Thrush, and Scarlet Tanager. The declining trends for these species have been consistent across years and special management consideration may be considered for these species. Additionally, several species are currently well below their estimated RNV values (Lind et al. 2005) and they may not remain common if their declining trends continue. For the past several years, we have been especially concerned about the widespread regional population declines of Ovenbird, a species that is both the most abundant species across our region and has been experiencing widespread population declines. While relative abundance for this species hit a regional low point in 2000, it has been slightly increasing annually since then in a manner similar to White-throated Sparrow. Being able to identify and distinguish between consistent population declines (e.g. >10 years) and shorter-term fluctuations or cycles in abundance is a critically important benefit of our long-term monitoring data.

Many of the declining species breed in mature forests, and many are ground-nesters. Some of these population declines may be linked to recent reductions in forest patch size and stand age on the landscape, especially in light of regional studies showing high nest predation on ground-nests near forest edges. Although the factors responsible for population declines are not definitively known, the prominence of declining ground-nesting species suggests that it would be prudent to curb further reductions in average forest patch sizes and age on the landscape. Several of these declining species have high PIF conservation values (e.g. Veery, Mourning Warbler, Eastern Wood-Pewee, Connecticut Warbler), and the extensive forests of northern Minnesota and Wisconsin represent excellent opportunities to provide “source” populations for many species.

LITERATURE CITED

- Bart, J., B. Collins, and R.I.G. Morrison. 2003. Estimating population trends with a linear model. *Condor* 105:367-372.
- Berg, B. 2001. Winter track survey summary, 2000. Forest Wildlife Populations and Research Group, Minnesota Department of Natural Resources. Grand Rapids, MN.
- Blackford, D. C. 2001. Spruce budworm project. Forest Insect and Disease Newsletter. July 2001. Minnesota Department of Natural Resources, Division of Forestry.
- Blake, J. G., J. M. Hanowski, G. J. Niemi, and P. T. Collins. 1994. Annual variation in bird populations of mixed conifer-northern hardwood forests. *Condor* 96:381-399.
- Buckland, S.T., Anderson, D.R., Burnham, K.P., Laake, J.L., Borchers, D.L. and Thomas, L. eds. 2004. *Advanced Distance Sampling*. Oxford University Press, Oxford. 414pp.
- Burnham, K.P. 1981. Summarizing Remarks: Environmental Influences. Pp324-325 in (C.J. Ralph and J. M. Scott, eds). *Estimating Numbers of Terrestrial Birds*. Studies In Avian Biology 6.
- Donovan, T. M., P. J. Jones, E. M. Annand, and F. R. Thompson, III. 1997. Variation in local-scale edge effects: mechanisms and landscape context. *Ecology* 78:2064-2075.
- Dufrene, M. and Legendre, P. 1997. Species assemblages and indicator species: the need for a flexible asymmetrical approach. *Ecological Monographs* 67(3):345-366.
- Etterson, M.A., N.P. Danz, J. Lind, J.M. Hanowski, and G.J. Niemi. 2007. 2006 Annual update report: breeding bird monitoring in Great Lakes national forests 1991-2006. NRR Technical Report NRR/TR-2007/06.

- Farnsworth, G.L., K.H. Pollock, J.D. Nichols, T.R. Simons, J.E. Hines, and J.R. Sauer. 2002. A removal model for estimating detection probabilities from point-count surveys. *Auk* 119(2):414-425.
- Fenske-Crawford, T. J., and G. J. Niemi. 1997. Predation of artificial ground nests at two types of edges in a forest-dominated landscape. *Condor* 99:14-24.
- Flaspohler, D. J., S. A. Temple, and R. N. Rosenfield. 2001. Species specific edge effects on nest success and breeding bird density in a forested landscape. *Ecological Applications* 11:32-46.
- Freemark, K., and B. Collins. 1992. Landscape ecology of birds breeding in temperate forest fragments. Pages 443-454 in *Ecology and conservation of Neotropical migrant landbirds* (J.M. Hagan and D.W. Johnston, eds). Smithsonian Institution Press, Washington, D.C.
- Green, J. C. 1995. *Birds and forests: A management and conservation guide*. Minnesota Department of Natural Resources. St. Paul, MN. 182 pp.
- Hanowski, J. M., and N. Danz. 2003. Response of breeding birds to forest plan revision alternatives in the Chippewa and Superior National Forests. Report to USDA Forest Service – Superior and Chippewa National Forests (available at <http://www.nrri.umn.edu/mnbirds/reports.htm>).
- Hanowski, J. M., and G. J. Niemi. 1995. Experimental design considerations for establishing an off-road, habitat specific bird monitoring program using point counts. Pages 145-150 in *Monitoring bird populations by point counts*. General Technical Report PSW-GTR-149. Pacific Southwest Research Station, Forest Service, U.S. Department of Agriculture, Albany, CA.
- Hanski, I.K., Fenske-Crawford, T.J., Niemi, G.J. (1996) Nest success of breeding birds in forested landscapes of northern Minnesota *Auk* 67:191-201
- Holmes, R. T., and T. W. Sherry. 1988. Assessing population trends of New Hampshire forest birds: Local vs. regional trends. *Auk* 105:756-768.
- Holmes, R. T., and T. W. Sherry. 2001. Thirty-year bird population trends in an unfragmented temperate deciduous forest: importance of habitat change. *Auk* 118:589-609.
- Howe, R. W., G. J. Niemi, G. J. Lewis, and D. A. Welsh. 1997. A standard method for monitoring songbird populations in the Great Lakes region. *Passenger Pigeon* 59:182-194.
- James, F. C., C. E. McCulloch, and D. A. Wiedenfeld. 1996. New approaches to the analysis of population trends in land birds. *Ecology* 77:13-27.
- Lind, J., N. Danz, M. T. Jones, J. M. Hanowski, and G. J. Niemi. 2001a. Breeding bird monitoring in Great Lakes National Forests: 1991-2000. Natural Resources Research Institute Technical Report: NRR/ITR-2001/4.
- Lind, J., N. Danz, M. T. Jones, J. M. Hanowski, and G. J. Niemi. 2001b. Breeding bird monitoring in Great Lakes National Forests: 1991-2001. Natural Resources Research Institute Technical Report: NRR/ITR-2001/39. (available at <http://www.nrri.umn.edu/mnbirds/reports.htm>)
- Lind, J., N. Danz, J. M. Hanowski, and G. J. Niemi. 2003. Breeding bird monitoring in Great Lakes National Forests: 1991-2003. Natural Resources Research Institute Technical Report: NRR/ITR-2003/46. (available at <http://www.nrri.umn.edu/mnbirds/reports.htm>)
- Lind, J., N. Danz, J. M. Hanowski, and G. J. Niemi. 2004. Breeding bird monitoring in Great Lakes National Forests: 1991-2004. Natural Resources Research Institute Technical Report: NRR/ITR-2005/04. (available at <http://www.nrri.umn.edu/mnbirds/reports.htm>)
- Lind, J., N. Danz, J. M. Hanowski, and G. J. Niemi. 2005. Breeding bird monitoring in Great Lakes National Forests: 1991-2005. Natural Resources Research Institute Technical Report: NRR/ITR-2005/04. (available at <http://www.nrri.umn.edu/mnbirds/reports.htm>)
- Link, W. A., and J. R. Sauer. 1997. New approaches to the analysis of population trends in land birds: comment. *Ecology* 78:2632-2634.

- Lynch, J. F., and D. F. Whigham. 1984. Effects of forest fragmentation on breeding bird communities in Maryland, U.S.A. *Biological Conservation* 28:287-324.
- Manley, P. N. and Monitoring Task Group. 1993. Guidelines for monitoring populations of neotropical migratory birds on National Forest System lands. U.S. For. Serv. Wildlife and Fisheries. U.S. Govt. Printing Office 1993-720-803/80195.
- Manly, B.F.J. 1991. Randomization and Monte Carlo methods in biology. Chapman & Hall, London, UK.
- Manolis, J. C., D. E. Andersen, and F. J. Cuthbert. 2000. Patterns in clearcut edge and fragmentation effect studies in northern hardwood-conifer landscapes: retrospective power analysis and Minnesota results. *Wildlife Society Bulletin* 28:1088-1101.
- MathSoft, Inc. 1999. S-Plus User's Guide, Data Analysis Products Division, MathSoft, Seattle, WA. 634 pp.
- National Audubon Society. 2004. The Christmas Bird Count historical results [Online]. Available <http://www.audubon.org/bird/cbc> [accessed Jan. 2005].
- Niemi, G.J., A. Lima, J. Hanowski, and L. Pfanmuller. 1996. Recent trends of breeding birds in Minnesota and Minnesota forested regions - 1966-1993. *The Loon* 67:191-201.
- Niemi, G. J., J. M. Hanowski, N. Danz, J. Lind, M. Jones, and J. Sales. 2003. Minnesota's Forest Bird Diversity Initiative. Natural Resources Research Institute Technical Report: NRRI/TR-2003/11.
- Peterjohn, B. G., J. R. Sauer, and C. S. Robbins. 1995. Population trends from the North American Breeding Bird Survey. Pages 3-39 in *Ecology and management of neotropical migratory birds* (T. E. Martin and D. M. Finch, eds.). Oxford University Press, New York.
- Ralph, C. J., G. R. Geupel, P. Pyle, T. E. Martin, and D. F. DeSante. 1993. Handbook of field methods for monitoring landbirds. Gen. Tech. Rep. PSW-GTR-144. Pacific Southwest Research Station, Forest Service, U.S. Department of Agriculture, Albany, CA. 41 pp.
- Ralph, C. J., J. R. Sauer, and S. Droege (eds.). 1995. Monitoring bird populations by point counts. Gen. Tech. Rep. PSW-GTR-149. Pacific Southwest Research Station, Forest Service, U.S. Department of Agriculture, Albany, CA. 181 pp.
- Rangen, S.A., K.A. Hobson, and R.G. Clark. 2000. A comparison of density and reproductive indices of songbirds in young and old boreal forest. *Wildlife Society Bulletin* 28:110-118
- Reynolds, R. T., J. M. Scott, and R. A. Nussbaum. 1980. A variable circular-plot method for estimating bird numbers. *Condor* 82:309-313.
- Rich, T.D., C.J. Beardmore, H. Berlanga, P.J. Blancher, M.S. Bradstreet, G.S. Butcher, D.W. Demarest, E.H. Dunn, W.C. Hunter, E.E. Iñigo-Elias, J.A. Kennedy, A.M. Martell, A.O. Panjabi, D.N. Pashley, K.V. Rosenberg, C.M. Rustay, J.S. Wendt, T.C. Will. 2004. Partners In Flight North American Landbird Conservation Plan. Cornell Lab of Ornithology, Ithaca, NY.
- Robinson, S. K., F. R. Thompson III, T. M. Donovan, D. R. Whitehead, and J. Faaborg. 1995. Regional forest fragmentation and the nesting success of migratory birds. *Science* 267:1987-1990.
- Sauer, J. R., J. E. Hines, and J. Fallon. 2004. The North American Breeding Bird Survey, Results and Analysis 1966 - 2003. Version 2004.1, USGS Patuxent Wildlife Research Center, Laurel, MD. <http://www.mbr-pwrc.usgs.gov/bbs/bbs.html>
- Sauer, J. R., G. W. Pendleton, and B. G. Peterjohn. 1996. Evaluating causes of population change in North American insectivorous songbirds. *Conserv. Biology* 10:465-478.
- Temple, S. A., and D. J. Flaspohler. 1998. The edge of the cut: implications for wildlife populations. *Journal of Forestry* 96:22-26.
- Urquhart, N. S., and T. M. Kincaid. 1999. Designs for detecting trend from repeated surveys of ecological resources. *Journal of Agricultural, Biological, and Environmental Statistics* 4:404-414.

- Virkkala, R. 1991. Spatial and temporal variation in bird communities and populations in north-boreal coniferous forests: a multiscale approach. *Oikos* 62:59-66.
- Weslowski, T., and L. Tomialojc. 1997. Breeding bird dynamics in a primaeval temperate forest: long-term trends in Bialowieza National Park (Poland). *Ecography* 20:432-453.
- Wolter, P. T., and M. A. White. 2002. Recent forest cover type transitions and landscape structural changes in northeast Minnesota. *Landscape Ecology* 17:133-155.

Table 1. Trends for three individual national forests (NF) and pooled NF's based on linear regression of loess-smoothed annual index of abundance (see Methods) (1991-2007). I = significantly increasing, D = significantly decreasing. * $P \leq 0.05$, ** $P \leq 0.01$. See Appendix A for species graphs and Appendix B for test statistics and sample sizes.

Species	Chequamegon NF	Chippewa NF	Superior NF	Pooled NFs
Ruffed Grouse			ns	
Yellow-bellied Sapsucker	ns	ns	ns	ns
Downy Woodpecker		ns		
Hairy Woodpecker	I*	ns	I**	I*
Northern Flicker	ns		I*	
Olive-sided Flycatcher		ns		
Eastern Wood-Pewee	D**	D**	D*	D**
Yellow-bellied Flycatcher	I**	I**	ns	I**
Alder Flycatcher	I*	ns	ns	ns
Least Flycatcher	ns	I*	ns	ns
Great Crested Flycatcher	D**	D**		
Eastern Kingbird	ns			
Yellow-throated Vireo	ns	ns		
Blue-headed Vireo	D**	ns	ns	ns
Red-eyed Vireo	I*	I**	I*	I**
Gray Jay		ns	ns	
Blue Jay	ns	ns	ns	ns
American Crow		D**		
Black-capped Chickadee	ns	I**	I**	I**
Red-breasted Nuthatch	I**	I**	I**	I**
White-breasted Nuthatch	ns	I**		
Brown Creeper	ns	ns	I*	ns
House Wren	ns			
Winter Wren	D**	D**	D**	D**
Golden-crowned Kinglet	ns	ns	I**	I**
Ruby-crowned Kinglet			ns	
Eastern Bluebird	ns			
Veery	D**	I*	D**	D**
Swainson's Thrush			ns	
Hermit Thrush	D**	D**	ns	D**
Wood Thrush	ns	I*		
American Robin	ns	I*	D**	ns
Gray Catbird		ns		
Brown Thrasher	D*			
Cedar Waxwing	ns	I**	I**	I**
Golden-winged Warbler	ns	ns	ns	ns

Table 1 (continued)

Species	Chequamegon NF	Chippewa NF	Superior NF	Pooled NFs
Tennessee Warbler			D**	
Nashville Warbler	ns	D*	I*	ns
Northern Parula	ns	ns	I**	I**
Yellow Warbler	I**	ns		
Chestnut-sided Warbler	I*	I**	ns	I**
Magnolia Warbler	ns	ns	I**	I**
Cape May Warbler			ns	
Black-throated Blue Warbler			I**	
Yellow-rumped Warbler	D**	ns	ns	ns
Black-throated Green Warbler	D*	I*	ns	ns
Blackburnian Warbler	I**	ns	ns	I**
Pine Warbler	ns	ns	ns	ns
Palm Warbler		ns		
Black-and-white Warbler	ns	I**	ns	I**
American Redstart	I**	I**	ns	I**
Ovenbird	D**	D**	D**	D**
Northern Waterthrush	ns	ns	ns	ns
Connecticut Warbler		D**		
Mourning Warbler	ns	ns	ns	ns
Common Yellowthroat	ns	ns	ns	D*
Canada Warbler	ns	I**	ns	ns
Scarlet Tanager	ns	D*	D**	D**
Eastern Towhee	I*			
Chipping Sparrow	ns	I**	ns	ns
Clay-colored Sparrow	ns			
Vesper Sparrow	ns			
Song Sparrow	ns	D*	ns	ns
Swamp Sparrow	ns	ns	ns	ns
White-throated Sparrow	ns	ns	ns	ns
Rose-breasted Grosbeak	I*	ns	D**	ns
Indigo Bunting	I**	ns		
Red-winged Blackbird	ns	ns		
Brewer's Blackbird	ns			
Brown-headed Cowbird	ns	D*		
Purple Finch	I*	ns	ns	ns
American Goldfinch	ns	I**		
Evening Grosbeak	D**			

Table 2. Species with significantly increasing trends ($P \leq 0.05$) for three national forests (1991-2007), based on simple linear regression. ** $P \leq 0.01$. Species graphs can be found in Appendix A.

<u>Increasing Species</u>	
<u>Chequamegon NF</u>	<u>Superior NF</u>
Hairy woodpecker	Hairy Woodpecker**
Yellow-bellied Flycatcher**	Northern Flicker
Alder Flycatcher	Red-eyed Vireo
Red-eyed Vireo	Black-capped Chickadee**
Red-breasted Nuthatch**	Red-breasted Nuthatch**
Yellow Warbler**	Brown Creeper
Chestnut-sided Warbler	Golden-crowned Kinglet**
Blackburnian Warbler**	Cedar Waxwing**
American Redstart**	Nashville Warbler
Eastern Towhee	Northern Parula**
Rose-breasted Grosbeak**	Magnolia Warbler**
Indigo Bunting	Black-throated Blue Warbler**
Purple Finch	
<u>Chippewa NF</u>	<u>Pooled national forests</u>
Yellow-bellied Flycatcher**	Hairy Woodpecker**
Least Flycatcher	Yellow-bellied Flycatcher**
Red-eyed Vireo**	Red-eyed Vireo**
Black-capped Chickadee**	Black-capped Chickadee**
Red-breasted Nuthatch**	Red-breasted Nuthatch**
White-breasted Nuthatch**	Golden-crowned Kinglet**
Veery	Cedar Waxwing**
Wood Thrush	Northern Parula**
American Robin	Chestnut-sided Warbler**
Cedar Waxwing**	Magnolia Warbler**
Chestnut-sided Warbler**	Blackburnian Warbler**
Black-throated Green Warbler	Black-and-white Warbler**
Black-and-white Warbler**	American Redstart**
American Redstart**	
Canada Warbler**	
Chipping Sparrow**	
American Goldfinch**	

Table 3. Summary of species with increasing trends ($P \leq 0.05$) on three national forests (1991-2007). Individual species graphs can be found in Appendix A.

Increased in one national forest	Increased in two national forests	Increased in three national forests
Northern Flicker	Hairy Woodpecker	Red-eyed Vireo
Alder Flycatcher	Yellow-bellied Flycatcher	Red-breasted Nuthatch
Least Flycatcher	Black-capped Chickadee	
White-breasted Nuthatch	Cedar Waxwing	
Brown Creeper	Chestnut-sided Warbler	
Golden-crowned Kinglet	American Redstart	
Veery		
Wood Thrush		
American Robin		
Nashville Warbler		
Northern Parula		
Yellow Warbler		
Magnolia Warbler		
Black-throated Blue Warbler		
Black-throated Green Warbler		
Blackburnian Warbler		
Black-and-white Warbler		
Canada Warbler		
Eastern Towhee		
Chipping Sparrow		
Rose-breasted Grosbeak		
Indigo Bunting		
Purple Finch		
American Goldfinch		

Table 4. Species with significantly decreasing trends ($P \leq 0.05$) for three national forests (1991-2007), based on simple linear regression. ** $P \leq 0.01$. Species graphs can be found in Appendix A.

<u>Decreasing Species</u>	
<u>Chequamegon NF</u>	<u>Superior NF</u>
Eastern Wood-Pewee**	Eastern Wood-Pewee*
Great Crested Flycatcher**	Winter Wren**
Blue-headed Vireo**	Veery**
Winter Wren**	American Robin**
Veery**	Tennessee Warbler**
Hermit Thrush**	Ovenbird**
Brown Thrasher	Scarlet Tanager**
Yellow-rumped Warbler**	Rose-breasted Grosbeak**
Black-throated Green Warbler*	
Ovenbird**	
Evening Grosbeak**	
<u>Chippewa NF</u>	<u>Pooled national forests</u>
Eastern Wood-Pewee**	Eastern Wood-Pewee**
Great Crested Flycatcher**	Winter Wren**
American Crow**	Veery**
Winter Wren**	Hermit Thrush**
Hermit Thrush**	Ovenbird**
Nashville Warbler	Common Yellowthroat*
Ovenbird**	Scarlet Tanager**
Connecticut Warbler**	
Scarlet Tanager*	
Song Sparrow*	
Brown-headed Cowbird	

Table 5. Summary of species with decreasing trends ($P \leq 0.05$) on three national forests (1991-2007). Individual species graphs can be found in Appendix A.

Decreased in one national forest	Decreased in two national forests	Decreased in three national forests
Blue-headed Vireo	Great Crested Flycatcher	Eastern Wood-Pewee
American Crow	Veery	Winter Wren
American Robin	Hermit Thrush	Ovenbird
Brown Thrasher	Scarlet Tanager	
Tennessee Warbler		
Nashville Warbler		
Myrtle Warbler		
Yellow-rumped Warbler		
Black-throated Green Warbler		
Connecticut Warbler		
Song Sparrow		
Rose-breasted Grosbeak		
Brown-headed Cowbird		
Evening Grosbeak		

Table 6. Summary of changes in trends on three national forests between 2006 and 2007

Species with new significant trends ($P \leq 0.05$) in 2007			
<i>Increasing in 2007</i>		<i>Decreasing in 2007</i>	
<u>Species</u>	<u>Study area</u>	<u>Species</u>	<u>Study area</u>
Hairy Woodpecker	Chequamegon	none	
Nashville Warbler	Superior		
Chestnut-sided Warbler	Chequamegon		
Black-throated Green Warbler	Chippewa		
Blackburnian Warbler	Pooled NFs		
Eastern Towhee	Chequamegon		
Rose-breasted Grosbeak	Chequamegon		
Indigo Bunting	Chequamegon		
Purple Finch	Chequamegon		
Yellow-bellied Flycatcher	Chequamegon, Chippewa		
Least Flycatcher	Chippewa		
Red-eyed Vireo	Chequamegon, Superior		
Red-breasted Nuthatch	Chequamegon		
Brown Creeper	Superior		
Veery	Chippewa		
Cedar Waxwing	Pooled NFs		

Species no longer showing significant trends ($P > 0.05$) in 2007			
<i>Was increasing in 2006</i>		<i>Was decreasing in 2006</i>	
<u>Species</u>	<u>Study area</u>	<u>Species</u>	<u>Study area</u>
American Redstart	Superior	Yellow-rumped Warbler	Pooled NFs
Northern Waterthrush	Chequamegon	Mourning Warbler	Chequamegon, Superior, Pooled NFs
Gray Catbird	Chippewa	Common Yellowthroat	Chequamegon
		Scarlet Tanager	Chequamegon
		Song Sparrow	Pooled NFs
		White-throated Sparrow	Chequamegon, Chippewa, Superior, Pooled NFs
		Red-winged Blackbird	Chequamegon
		Purple Finch	Chippewa

analyses.

Table 7. Test statistics and sample sizes for guild trend analyses on three national forests (1991-2007). All species combined within each guild category and analyzed as a group, regardless of whether a species meets criteria for individual species analyses. Change = percent annual change. N = number of stands analyzed. See Appendix A for trend graphs.

Guild Category	Chequamegon NF				Chippewa NF				Superior NF				Pooled National Forests			
	change	P	R ²	N	change	P	R ²	N	change	P	R ²	N	change	P	R ²	N
Short-distance migrants	-1.3	0.00	0.84	129	-0.1	0.80	0.01	126	0.1	0.87	0.00	147	-0.4	0.06	0.11	402
Long-distance migrants	-0.3	0.14	0.71	129	0.8	0.00	0.4	126	-0.2	0.28	0.1	147	0.01	0.97	0.00	402
Permanent residents	0.8	0.17	0.35	121	4.2	0.00	0.87	125	3.8	0.00	0.93	146	3.1	0.00	0.87	392
Ground nesting	-1.7	0.00	0.72	129	-0.9	0.00	0.19	126	-1.0	0.00	0.44	147	-1.3	0.00	0.46	402
Shrub/Sub-canopy nesting	0.86	0.05	0.56	129	2.5	0.00	0.93	126	0.7	0.04	0.79	147	1.4	0.00	0.87	402
Canopy nesting	-0.6	0.06	0.68	124	0.2	0.56	0.06	126	1.0	0.00	0.56	147	0.3	0.27	0.17	397
Cavity nesting	0.73	0.18	0.42	126	3.6	0.00	0.70	126	4.8	0.00	0.89	147	3.1	0.00	0.81	399
Coniferous forest	0.8	0.12	0.38	108	2.3	0.00	0.79	111	2.5	0.00	0.88	146	2.0	0.00	0.8	365
Lowland coniferous	-0.6	0.24	0.17	108	-1.4	0.00	0.70	102	0.2	0.41	0.15	147	-0.6	0.01	0.30	357
Deciduous forest	-0.9	0.00	0.96	128	0.7	0.00	0.18	126	-0.3	0.26	0.46	147	-0.09	0.55	0.03	401
Early-succession	1.6	0.17	0.93	103	2.3	0.00	0.87	119	-0.3	0.61	0.02	145	0.6	0.2	0.11	367
Mixed forest	-2.3	0.00	0.84	121	0.3	0.50	0.05	125	-0.1	0.82	0.00	147	-0.6	0.02	0.17	393

Appendix B. Trend estimates (% annual change) and associated test statistics 1991-2007.

Species	Chequamegon NF				Chippewa NF				Superior NF				Pooled NF's			
	Trend	P	R ²	n	Trend	P	R ²	n	Trend	P	R ²	n	Trend	P	R ²	n
Ruffed Grouse	--	--	--	--	--	--	--	--	-11.8	0.06	0.87	5	--	--	--	--
Yellow-bellied Sapsucker	1.66	0.11	0.51	71	1.27	0.17	0.13	66	1.03	0.33	0.45	67	1.2	0.07	0.4	204
Downy Woodpecker	--	--	--	--	1.38	0.62	0.16	10	--	--	--	--	--	--	--	--
Hairy Woodpecker	4.57	0.04	0.79	29	-1.71	0.61	0.31	8	9.26	0	0.94	7	4.23	0.02	0.8	44
Northern Flicker	2.6	0.67	0.52	6	--	--	--	--	6.35	0.03	0.76	14	--	--	--	--
Olive-sided Flycatcher	--	--	--	--	1.52	0.77	0.71	6	--	--	--	--	--	--	--	--
Eastern Wood-Pewee	-5.15	0	0.84	62	-4.15	0	0.93	68	-6.37	0.02	0.67	16	-4.88	0	0.88	146
Yellow-bellied Flycatcher	3.11	0	0.82	25	3.52	0.01	0.73	23	1.58	0.09	0.69	63	2.45	0	0.87	111
Alder Flycatcher	4.05	0.03	0.94	20	0.92	0.62	0.32	14	-0.59	0.75	0.21	25	1.98	0.09	0.79	59
Least Flycatcher	-1.82	0.25	0.66	69	1.53	0.02	0.6	76	0.62	0.7	0.55	69	0.52	0.45	0.2	214
Great Crested Flycatcher	-4.78	0	0.92	28	-8.25	0	0.88	25	--	--	--	--	--	--	--	--
Eastern Kingbird	0.78	0.81	0.06	9	--	--	--	--	--	--	--	--	--	--	--	--
Yellow-throated Vireo	-3.32	0.49	0.44	5	-0.95	0.6	0.11	29	--	--	--	--	--	--	--	--
Blue-headed Vireo	-5.14	0.01	0.82	22	3.29	0.11	0.86	26	1.65	0.54	0.37	22	0.51	0.76	0.21	70
Red-eyed Vireo	0.57	0.03	0.2	118	1.73	0	0.7	120	0.82	0.02	0.33	146	1.18	0	0.73	384
Gray Jay	--	--	--	--	-1.91	0.65	0.46	6	1.27	0.66	0.43	13	--	--	--	--
Blue Jay	0.91	0.39	0.63	87	1.05	0.52	0.24	65	1.53	0.17	0.54	91	1.3	0.06	0.82	243
American Crow	--	--	--	--	-7.11	0	0.88	5	--	--	--	--	--	--	--	--
Black-capped Chickadee	0.42	0.65	0.18	90	7.61	0	0.93	83	8.32	0	0.96	68	5.18	0	0.96	241
Red-breasted Nuthatch	5.16	0	0.58	48	7.57	0	0.81	57	6.2	0	0.75	78	6.45	0	0.75	183
White-breasted Nuthatch	-2.76	0.2	0.47	20	6.98	0	0.81	27	--	--	--	--	--	--	--	--
Brown Creeper	-1.19	0.34	0.32	54	1.2	0.34	0.23	39	3.19	0.03	0.77	41	0.93	0.25	0.23	134
House Wren	-0.86	0.46	0.11	5	--	--	--	--	--	--	--	--	--	--	--	--
Winter Wren	-9.03	0	0.93	45	-5.02	0	0.97	46	-3.55	0	0.66	74	-5.21	0	0.88	165
Golden-crowned Kinglet	-0.4	0.82	0.18	17	3.19	0.16	0.43	21	5.5	0	0.74	58	4.1	0	0.68	96
Ruby-crowned Kinglet	--	--	--	--	--	--	--	--	-3.2	0.13	0.45	10	--	--	--	--
Eastern Bluebird	5.85	0.24	0.84	5	--	--	--	--	--	--	--	--	--	--	--	--
Veery	-4.59	0	0.91	62	1.72	0.02	0.7	90	-3.83	0	0.97	114	-1.58	0	0.8	266
Swainson's Thrush	--	--	--	--	--	--	--	--	0.35	0.79	0.02	39	--	--	--	--
Hermit Thrush	-7.29	0	0.97	88	-3.15	0	0.7	72	-0.56	0.55	0.63	82	-3.62	0	0.92	242
Wood Thrush	-2.88	0.32	0.21	12	7.21	0.05	0.93	5	--	--	--	--	--	--	--	--
American Robin	-0.23	0.78	0.01	95	2.52	0.04	0.76	70	-1.8	0.01	0.69	109	0.09	0.88	0	274
Gray Catbird	--	--	--	--	6.04	0.07	0.48	14	--	--	--	--	--	--	--	--
Brown Thrasher	-3.51	0.04	0.79	11	--	--	--	--	--	--	--	--	--	--	--	--
Cedar Waxwing	6.51	0.12	0.98	6	7.24	0	0.82	23	8.09	0	0.98	23	7.58	0	0.97	52
Golden-winged Warbler	2.23	0.59	0.53	11	-0.08	0.88	0	24	0.58	0.89	0.04	12	0.5	0.87	0.32	47
Tennessee Warbler	--	--	--	--	--	--	--	--	-16.3	0	0.93	9	--	--	--	--
Nashville Warbler	1.21	0.11	0.33	94	-1.17	0.02	0.63	87	0.77	0.02	0.66	145	0.11	0.68	0.01	326
Northern Parula	1.14	0.38	0.55	30	1.16	0.44	0.71	31	3.44	0	0.87	64	2.34	0	0.89	125
Yellow Warbler	10.2	0.01	0.92	7	-4.41	0.4	0.56	11	--	--	--	--	--	--	--	--
Chestnut-sided Warbler	3.12	0.05	0.98	76	3.62	0	0.9	101	0.62	0.35	0.2	134	1.84	0	0.72	311
Magnolia Warbler	6.97	0.26	0.83	6	2.6	0.63	0.42	11	3.06	0	0.94	105	3.05	0	0.97	122
Cape May Warbler	--	--	--	--	--	--	--	--	9.35	0.13	0.76	7	--	--	--	--
Black-throated Blue Warbler	--	--	--	--	--	--	--	--	10	0	0.98	11	--	--	--	--
Yellow-rumped Warbler	-3.57	0	0.74	52	-1.17	0.18	0.29	54	0.52	0.58	0.08	83	-1	0.08	0.28	189

Species	Chequamegon NF				Chippewa NF				Superior NF				Pooled NF's			
	Trend	P	R ²	n	Trend	P	R ²	n	Trend	P	R ²	n	Trend	P	R ²	n
Black-throated Green Warbler	-1.28	0.02	0.92	91	2.26	0.02	0.67	54	0.38	0.64	0.03	68	0.32	0.34	0.09	213
Blackburnian Warbler	3.98	0	0.94	62	0.34	0.7	0.02	63	0.79	0.26	0.49	107	1.34	0.01	0.81	232
Pine Warbler	2.67	0.09	0.81	21	1.06	0.31	0.35	43	1.98	0.12	0.33	8	1.31	0.09	0.49	72
Palm Warbler	--	--	--	--	4.26	0.12	0.79	9	--	--	--	--	--	--	--	--
Black-and-white Warbler	0.29	0.78	0.02	57	5.88	0	0.94	63	1.09	0.14	0.28	125	2.02	0	0.6	245
American Redstart	7.27	0	0.78	33	3.54	0	0.96	61	2.03	0.1	0.83	63	3.48	0	0.89	157
Ovenbird	-2.01	0	0.81	114	-1.99	0	0.28	111	-1.14	0	0.66	142	-1.61	0	0.58	367
Northern Waterthrush	1.36	0.27	0.08	10	9.97	0.08	0.95	6	-2.47	0.2	0.37	7	3.14	0.12	0.55	23
Connecticut Warbler	--	--	--	--	-13.2	0	0.95	14	--	--	--	--	--	--	--	--
Mourning Warbler	-1.99	0.35	0.52	43	0.35	0.83	0.02	56	-1.48	0.08	0.67	115	-1.29	0.09	0.5	214
Common Yellowthroat	-2.77	0.07	0.85	45	-0.69	0.56	0.24	70	-3.47	0.18	0.92	41	-1.7	0.02	0.76	156
Canada Warbler	2.25	0.25	0.55	32	10.1	0.01	0.91	11	0.77	0.45	0.13	84	1.54	0.11	0.35	127
Scarlet Tanager	-2.48	0.06	0.94	57	-2.49	0.04	0.78	72	-8.86	0.01	0.85	11	-2.95	0	0.91	140
Eastern Towhee	5.41	0.05	0.99	19	--	--	--	--	--	--	--	--	--	--	--	--
Chipping Sparrow	-1.13	0.56	0.47	23	3.09	0.01	0.84	57	0.29	0.75	0.02	43	1.59	0.07	0.64	123
Clay-colored Sparrow	-0.92	0.64	0.29	12	--	--	--	--	--	--	--	--	--	--	--	--
Vesper Sparrow	3.87	0.09	0.97	10	--	--	--	--	--	--	--	--	--	--	--	--
Song Sparrow	-1.55	0.56	0.74	30	-4.56	0.03	0.82	45	0.01	0.98	0	26	-2.62	0.09	0.8	101
Swamp Sparrow	-4.48	0.06	0.96	15	3.07	0.07	0.78	23	6.17	0.08	0.88	10	1.39	0.23	0.33	48
White-throated Sparrow	-1.16	0.48	0.12	45	-0.87	0.34	0.04	53	-0.76	0.37	0.04	134	-1.1	0.07	0.07	232
Rose-breasted Grosbeak	2.94	0.03	0.93	78	2.08	0.11	0.29	56	-3.65	0	0.61	72	0.17	0.8	0.01	206
Indigo Bunting	9.45	0	0.89	18	5.13	0.09	0.93	18	--	--	--	--	--	--	--	--
Red-winged Blackbird	-8.56	0.06	0.9	6	-5.02	0.19	0.44	6	--	--	--	--	--	--	--	--
Brewer's Blackbird	-0.48	0.7	0.01	6	--	--	--	--	--	--	--	--	--	--	--	--
Brown-headed Cowbird	-0.1	0.89	0.01	33	-6.01	0.04	0.71	22	--	--	--	--	--	--	--	--
Purple Finch	11.7	0.02	0.86	5	-1.79	0.48	0.2	12	1.1	0.8	0.16	6	1.57	0.55	0.2	23
American Goldfinch	1.24	0.79	0.22	13	11.3	0	0.76	14	--	--	--	--	--	--	--	--
Evening Grosbeak	-17.4	0	0.94	6	--	--	--	--	--	--	--	--	--	--	--	--

Appendix C. Common and scientific name, abbreviation, migration strategy, and typical nest site of each species tested.

Common Name	Scientific Name	Abbrev	Migration Strategy	Nest Site	Vegetation-type
Ruffed Grouse	<i>Bonasa umbellus</i>	RUGR	Permanent Resident	Ground	Deciduous Forest
Yellow-bellied Sapsucker	<i>Sphyrapicus varius</i>	YBSA	Short-distance	Cavity	Deciduous Forest
Downy Woodpecker	<i>Picoides pubescens</i>	DOWO	Permanent Resident	Cavity	Deciduous Forest
Hairy Woodpecker	<i>Picoides villosus</i>	HAWO	Permanent Resident	Cavity	Deciduous Forest
Northern Flicker	<i>Colaptes auratus</i>	YSFL	Short-distance	Cavity	Fields and Meadows
Olive-sided Flycatcher	<i>Contopus cooperi</i>	OSFL	Long-distance	Canopy	Early Successional
Eastern Wood-Pewee	<i>Contopus virens</i>	EAWP	Long-distance	Canopy	Mixed Forest
Yellow-bellied Flycatcher	<i>Empidonax flaviventris</i>	YBFL	Long-distance	Ground	Lowland Coniferous
Alder Flycatcher	<i>Empidonax alorum</i>	ALFL	Long-distance	Shrub or Subcanopy	Early Successional
Least Flycatcher	<i>Empidonax minimus</i>	LEFL	Long-distance	Shrub or Subcanopy	Deciduous Forest
Great Crested Flycatcher	<i>Myiarchus crinitus</i>	GCFL	Long-distance	Cavity	Deciduous Forest
Eastern Kingbird	<i>Tyrannus tyrannus</i>	EAKI	Long-distance	Shrub or Subcanopy	Fields and Meadows
Yellow-throated Vireo	<i>Vireo flavifrons</i>	YTVI	Long-distance	Canopy	Deciduous Forest
Blue-headed Vireo	<i>Vireo solitarius</i>	BHVI	Long-distance	Shrub or Subcanopy	Coniferous Forest
Red-eyed Vireo	<i>Vireo olivaceus</i>	REVI	Long-distance	Shrub or Subcanopy	Deciduous Forest
Gray Jay	<i>Perisoreus canadensis</i>	GRAJ	Permanent Resident	Shrub or Subcanopy	Lowland Coniferous
Blue Jay	<i>Cyanocitta cristata</i>	BLJA	Permanent Resident	Canopy	Deciduous Forest
American Crow	<i>Corvus brachyrhynchos</i>	AMCR	Short-distance	Canopy	Deciduous Forest
Black-capped Chickadee	<i>Poecile atricapillus</i>	BCCH	Permanent Resident	Cavity	Deciduous Forest
Red-breasted Nuthatch	<i>Sitta canadensis</i>	RBNU	Permanent Resident	Cavity	Coniferous Forest
White-breasted Nuthatch	<i>Sitta carolinensis</i>	WBNU	Permanent Resident	Cavity	Deciduous Forest
Brown Creeper	<i>Certhia americana</i>	BRCR	Short-distance	Cavity	Deciduous Forest
House Wren	<i>Troglodytes aedon</i>	HOWR	Short-distance	Cavity	Urban
Winter Wren	<i>Troglodytes troglodytes</i>	WIWR	Short-distance	Ground	Lowland Coniferous
Golden-crowned Kinglet	<i>Regulus satrapa</i>	GCKI	Short-distance	Canopy	Coniferous Forest
Ruby-crowned Kinglet	<i>Regulus calendula</i>	RCKI	Short-distance	Canopy	Coniferous Forest
Veery	<i>Catharus fuscescens</i>	VEER	Long-distance	Ground	Deciduous Forest
Swainson's Thrush	<i>Catharus ustulatus</i>	SWTH	Long-distance	Shrub or Subcanopy	Lowland Coniferous
Hermit Thrush	<i>Catharus guttatus</i>	HETH	Short-distance	Ground	Mixed Forest
Wood Thrush	<i>Hylocichla mustelina</i>	WOTH	Long-distance	Shrub or Subcanopy	Deciduous Forest
American Robin	<i>Turdus migratorius</i>	AMRO	Short-distance	Shrub or Subcanopy	Fields and Meadows
Gray Catbird	<i>Dumetella carolinensis</i>	GRCA	Long-distance	Shrub or Subcanopy	Early Successional
Brown Thrasher	<i>Toxostoma rufum</i>	BRTTH	Short-distance	Shrub or Subcanopy	Early Successional
Cedar Waxwing	<i>Bombycilla cedrorum</i>	CEDW	Short-distance	Shrub or Subcanopy	Ponds, Lakes, Streams
Golden-winged Warbler	<i>Vermivora chrysoptera</i>	GWWA	Long-distance	Ground	Early Successional
Tennessee Warbler	<i>Vermivora peregrina</i>	TEWA	Long-distance	Ground	Lowland Coniferous
Nashville Warbler	<i>Vermivora ruficapilla</i>	NAWA	Long-distance	Ground	Lowland Coniferous

Common Name	Scientific Name	Abbrev	Migration Strategy	Nest Site	Vegetation-type
Northern Parula	<i>Parula americana</i>	NOPA	Long-distance	Canopy	Lowland Coniferous
Yellow Warbler	<i>Dendroica petechia</i>	YWAR	Long-distance	Shrub or Subcanopy	Shrub Swamp
Chestnut-sided Warbler	<i>Dendroica pensylvanica</i>	CSWA	Long-distance	Shrub or Subcanopy	Early Successional
Magnolia Warbler	<i>Dendroica magnolia</i>	MAWA	Long-distance	Shrub or Subcanopy	Coniferous Forest
Cape May Warbler	<i>Dendroica tigrina</i>	CMWA	Long-distance	Canopy	Coniferous Forest
Black-thr. Blue Warbler	<i>Dendroica caerulescens</i>	BTBW	Long-distance	Shrub or Subcanopy	Deciduous Forest
Yellow-rumped Warbler	<i>Dendroica coronata</i>	MYWA	Short-distance	Canopy	Coniferous Forest
Black-thr. Green Warbler	<i>Dendroica virens</i>	BTNW	Long-distance	Canopy	Mixed Forest
Blackburnian Warbler	<i>Dendroica fusca</i>	BLBW	Long-distance	Canopy	Coniferous Forest
Pine Warbler	<i>Dendroica pinus</i>	PIWA	Short-distance	Canopy	Coniferous Forest
Palm Warbler	<i>Dendroica palmarum</i>	WPWA	Long-distance	Ground	Lowland Coniferous
Black-and-white Warbler	<i>Mniotilta varia</i>	BAWW	Long-distance	Ground	Mixed Forest
American Redstart	<i>Setophaga ruticilla</i>	AMRE	Long-distance	Shrub or Subcanopy	Early Successional
Ovenbird	<i>Seiurus aurocapilla</i>	OVEN	Long-distance	Ground	Deciduous Forest
Northern Waterthrush	<i>Seiurus noveboracensis</i>	NOWA	Long-distance	Ground	Lowland Coniferous
Connecticut Warbler	<i>Oporornis agilis</i>	CONW	Long-distance	Ground	Lowland Coniferous
Mourning Warbler	<i>Oporornis philadelphia</i>	MOWA	Long-distance	Ground	Early Successional
Common Yellowthroat	<i>Geothlypis trichas</i>	COYE	Short-distance	Ground	Shrub Swamp
Canada Warbler	<i>Wilsonia canadensis</i>	CAWA	Long-distance	Ground	Mixed Forest
Scarlet Tanager	<i>Piranga olivacea</i>	SCTA	Long-distance	Canopy	Deciduous Forest
Eastern Towhee	<i>Pipilo erythrophthalmus</i>	EATO	Short-distance	Ground	Early Successional
Chipping Sparrow	<i>Spizella passerina</i>	CHSP	Short-distance	Canopy	Coniferous Forest
Clay-colored Sparrow	<i>Spizella pallida</i>	CCSP	Short-distance	Ground	Fields and Meadows
Vesper Sparrow	<i>Poocetes gramineus</i>	VESP	Short-distance	Ground	Fields and Meadows
Song Sparrow	<i>Melospiza melodia</i>	SOSP	Short-distance	Ground	Fields and Meadows
Swamp Sparrow	<i>Melospiza georgiana</i>	SWSP	Short-distance	Ground	Early Successional
White-throated Sparrow	<i>Zonotrichia albicollis</i>	WTSP	Short-distance	Ground	Early Successional
Rose-breasted Grosbeak	<i>Pheucticus ludovicianus</i>	RBGR	Long-distance	Shrub or Subcanopy	Deciduous Forest
Indigo Bunting	<i>Passerina cyanea</i>	INBU	Long-distance	Shrub or Subcanopy	Fields and Meadows Ponds, Lakes, Streams
Red-winged Blackbird	<i>Agelaius phoeniceus</i>	RWBL	Short-distance	Shrub or Subcanopy	
Brewer's Blackbird	<i>Euphagus cyanocephalus</i>	BRBL	Short-distance	Ground	Fields and Meadows
Brown-headed Cowbird	<i>Molothrus ater</i>	BHCO	Short-distance	Brood Parasite	Fields and Meadows
Purple Finch	<i>Carpodacus purpureus</i>	PUFI	Permanent Resident	Canopy	Mixed Forest
American Goldfinch	<i>Carduelis tristis</i>	AMGO	Short-distance	Shrub or Subcanopy	Fields and Meadows
Evening Grosbeak	<i>Coccothraustes vespertinus</i>	EVGR	Permanent Resident	Canopy	Mixed Forest

Appendix D. Number of observations on the Chequamegon National Forest for species not tested for trends in 2007. Includes flyovers and all birds regardless of distance.

Species	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Common Loon			8	6	12	10	12	5	9	19	14	11	6	2	9	9
Pied-billed Grebe					1	2					2		1	1		
Double-crested Cormorant										11						
American Bittern			5	4	2	6	1	1	1	1	13	17	2	5	4	2
Great Blue Heron			2		1			15	14	1	2	4	3		4	
Green Heron									1							
Canada Goose			2	1	2	2	19	10	74	50	66	176	56	32	13	19
Wood Duck	6		1	1	1						3	1			2	1
Mallard	2	2	1		1			5	3	1	2	2		5	3	
Blue-winged Teal		1														
Hooded Merganser														1		
Osprey										1	1					
Northern Harrier									2	1		3	1		2	
Sharp-shinned Hawk									2							
Cooper's Hawk		1				1										
Northern Goshawk		1											1	1		
Red-shouldered Hawk			1		1		1	1	1	2				1	1	
Broad-winged Hawk	5	2	4	3		3	4	6	7	4	7	2	7	3	3	13
Red-tailed Hawk			2				3	2		2	2	5	6	1		
American Kestrel										1					2	3
Ring-necked Pheasant					1											
Ruffed Grouse	1	4	11	31	66	96	15	28	29	20	86	77	68	19	24	14
Wild Turkey						1									3	10
Virginia Rail									1							
Sora								1	2							
Sandhill Crane			2	1	18	15	11	11	11	3	24	31	20	15	18	17
Killdeer	3	1			1										4	1
Upland Sandpiper	7	4	12	2	10	5	17	8	3	9	7	1	1	8	4	9
Common Snipe	1	1		1	1	1	4	1	1	1	4	8	2	4	4	
American Woodcock		1		1									2		2	
Mourning Dove	1		3	8	4	2	11	9	20	25	40	57	38	38	48	64
Black-billed Cuckoo	3			4		1	2	3	15	25	9	17		2	2	19
Yellow-billed Cuckoo		3		14		1	24	2	10	6	1	1			2	
Great Horned Owl	1									1						3
Barred Owl			5	3	4	3	15	9	10	4	13	7		4	5	6
Common Nighthawk	1			1		1	3	6	1	1	2				2	1
Whip-poor-will		1	1		2						1					
Chimney Swift								1			1					3

Appendix D. Number of observations on the Chequamegon National Forest for species not tested for trends in 2007. Includes flyovers and all birds regardless of distance.

Species	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Ruby-throated Hummingbird	2	2	2	5	4	2	3	1	15	4	8	5	6	11	12	23
Belted Kingfisher								1			1			2		
Red-headed Woodpecker				1							1					
Red-bellied Woodpecker							1							1	3	
Downy Woodpecker	13	6	5	8	2	6	2	2	5	12	9	8	8	11	11	3
Black-backed Woodpecker		1		1			2	1							1	
Pileated Woodpecker	4	5	3	9	1	1	3	9	18	15	24	29	33	24	24	31
Olive-sided Flycatcher		1	4	1	6	1	3		13	5	9	5	1	4	2	1
Eastern Phoebe	2			1	2	2	2	3	2	2	9	4	3	6	7	5
Warbling Vireo			1		2			1	1		5		1			
Philadelphia Vireo						1										
Gray Jay	4	7		1	1	2	5	4	2		6	1		2	2	4
American Crow		2	34	55	88	112	132	82	207	196	210	262	127	86	107	114
Common Raven	1		28	20	37	65	28	46	83	73	134	72	41	78	83	90
Purple Martin									1						1	
Tree Swallow	9	1	1	10	7	8	13	17	30	26	30	24	63	33	20	19
Bank Swallow								1								
Barn Swallow							1		1							
Boreal Chickadee			2						1					2		
Sedge Wren	2		7	14	6	12	3	2	8	7	17		14	10	6	9
Marsh Wren								1								1
Ruby-crowned Kinglet	2	7	1	7	1	1	2	4		1	2		2	1		
Blue-gray Gnatcatcher										3						
Swainson's Thrush		1	9	3	4	4	7	3				5	4			2
Gray Catbird	2	3	1	3	3	3	4	5	3	6	10	1	18	5	4	24
Northern Mockingbird												1				
European Starling	1											2			5	
Blue-winged Warbler					1	1	3									
Tennessee Warbler			5	3		2					2	1	1			
Cape May Warbler	1	2	4	10	1	3	9	5	1	2	2	5		1		3
Black-throated Blue Warbler	6	7	10	8	7	4	8	11	3	1	6	5	4	9	3	3
Palm Warbler (Western)	5	5	3		6	6	7	11	4	11	3	10	11	9	13	8
Bay-breasted Warbler			2	4							1					
Connecticut Warbler	12	8	7	3	12	4	7	2	4	4	5			2	1	1
Wilson's Warbler				4												
Field Sparrow	2	2	2	4		4	3			8	8	4	2	6	2	9
Savannah Sparrow	7	7	6	5	14	2	8	6	8	7	10	11	14	14	20	18
Le Conte's Sparrow	1			1		1					1	3				2

Appendix D. Number of observations on the Chequamegon National Forest for species not tested for trends in 2007. Includes flyovers and all birds regardless of distance.

Species	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Lincoln's Sparrow	9	11	2	2	13	10	2	2	9	4	14	15	16	13	15	10
Dark-eyed Junco (Slate-colored)	1	4	43	2	9	1	2	5	2			1	2		1	1
Northern Cardinal	1				2				1	1						1
Dickcissel				2												
Bobolink												2	1			
Eastern Meadowlark		2						2			1					
Western Meadowlark			4									1				
Common Grackle			1	4		2	2	12	2	19	7	5	1	9	7	7
Baltimore Oriole	1	1	2	1	6		4	2	4	8	13	24	12	3	2	4
Red Crossbill										9			36	4	1	8
Pine Siskin								2		4	7			3		28

Appendix E. Number of observations on the Chippewa National Forest for species not tested for trends in 2007. Includes flyovers and all birds regardless of distance.

Species	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Common Loon		1		21	27	26	37	43	80	83	49	73	67	87	55	70	62
Pied-billed Grebe											7				2	1	
American White Pelican									1				2				3
American Bittern		1		1					1								
Great Blue Heron		1			2				4	4	4		6	5	4	4	1
Green Heron												2	1				2
Turkey Vulture				1		1				1		1		1	1		1
Canada Goose									2		3		4			2	2
Wood Duck									1	1	14	1	4				1
Mallard						1			9	7	1	1	1		1	8	1
Green-winged Teal									5								1
Ring-necked Duck											2						
Hooded Merganser												1					2
Common Merganser										1			9				1
Osprey					1				1	1	1		1				
Bald Eagle	1			1		1			1	1	1	1			1	1	2
Northern Harrier									1								
Sharp-shinned Hawk	1	1					4										
Cooper's Hawk		1							1		1	2		1			1
Northern Goshawk		1															2
Red-shouldered Hawk						1					1						
Broad-winged Hawk		4	4	4	4	5	2	6	1	4	6	7	8	10	5	5	8
Red-tailed Hawk	1				2	1	2	3	4		11	1	7	2	5	2	
American Kestrel												1			1		
Merlin								1					1				
Ruffed Grouse	4	3	2	1	6	7	4	18	13	1	10	3	9	4		5	2
Virginia Rail				1													1
Sora									1	2	1	2					
Sandhill Crane												8			1	2	
Killdeer	1				1		1			1		2	1				1
Solitary Sandpiper									1								
Common Snipe	1	1	4	4		5	2	6	4	6	1	8	10	19	2	2	4
American Woodcock				1									2		2		
Ring-billed Gull										3					1		
Herring Gull										2							1

Appendix E. Number of observations on the Chippewa National Forest for species not tested for trends in 2007. Includes flyovers and all birds regardless of distance.

Species	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Mourning Dove	1				3	1			4	1	6	7	11	13	1	7	6
Black-billed Cuckoo	5	3		6	3	1	2		9	2	2	7	2	1		21	11
Yellow-billed Cuckoo		1			8		1	22			2					1	
Great Horned Owl										1		2					
Barred Owl								3	1	2		2	4	3	1	5	2
Great Gray Owl										1					1		
Long-eared Owl																	3
Common Nighthawk					1				5	3			2			1	
Whip-poor-will				1					2								2
Chimney Swift				1				1		2	2	3					2
Ruby-throated Hummingbird	3	5	3	2	5	3	6	10	10	11	8	9	13	7	14	10	15
Belted Kingfisher				1		3	3	1	1		4	5	3	2	1	3	4
Red-headed Woodpecker							1					1					
Red-bellied Woodpecker																1	
Black-backed Woodpecker					1			1	3	2	2	4	1	2			13
Northern Flicker (Yellow-shafted)	9	17	4	9	13	4	12	11	17	22	25	17	17	28	38	37	23
Pileated Woodpecker	11	4	2	7	4	5	6	9	10	24	11	15	16	41	10	28	25
Willow Flycatcher					2	1		1									
Eastern Phoebe	3	4		1	1	2	3	2	2	5		2	5	3	5	4	2
Eastern Kingbird	6	1	1	2	4		3	4	3		3	3	2	6	11	6	5
Warbling Vireo	1					2	3	1							3	2	1
Philadelphia Vireo				4													
Common Raven	1	3		7	10	40	26	25	49	65	68	53	54	41	35	44	35
Purple Martin		1							1					3			
Tree Swallow		5	7			1			1	9	2	1		3	1	3	6
Cliff Swallow										12							
Barn Swallow										2		1					
Boreal Chickadee	3	2			1						1	4	4	4	5		
House Wren			1	3	1			1	6	2	4	1	6	3	2	2	8
Sedge Wren	1		1	10	1	5	4	4	3	1	5	3		5	1		5
Marsh Wren				2													

Appendix E. Number of observations on the Chippewa National Forest for species not tested for trends in 2007. Includes flyovers and all birds regardless of distance.

Species	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Ruby-crowned Kinglet		1	4	2	3		2	4	3	1		2			2		1
Eastern Bluebird		3						2	1	4	3	9	5		2		1
Swainson's Thrush	1	1	2	6	7	1	2	17	5	4	2	4	13			1	
Brown Thrasher		1	1							1	1				2		
Tennessee Warbler		2	1	3					2	2							1
Cape May Warbler	1			4	2				4		1	1	2			1	1
Black-throated Blue Warbler	1	1	1	1	2		2	1	3						1	1	
Bay-breasted Warbler				3													
Blackpoll Warbler							1										
Eastern Towhee				5	5	2	1	1	8	3	7	7	1	6		7	12
Clay-colored Sparrow		2					2	2			10	10	8	5	6		7
Vesper Sparrow			1		1									1			8
Savannah Sparrow			1					1									
Le Conte's Sparrow	1																
Lincoln's Sparrow	4	1			1	2	2	4	1	6	1	1		10	7	8	5
Dark-eyed Junco (Slate-colored)	15	1		4	10	3	1	1		4		5	1				1
Brewer's Blackbird		1						3		3	6	4					
Common Grackle	2			1	1	1		2	9	14	2	2	5		3	6	7
Baltimore Oriole	3	8	11	6	5	5	1	2	2	5	1	2	11	1	1	3	2
Red Crossbill				2						2	26			2	11	27	5
White-winged Crossbill					1	23		1		50							2
Pine Siskin				2	1	4	1		9	23	2	3			10	1	9
Evening Grosbeak	7	11	1	3		3	3	14	20	34	1	14	6	9	9	8	2

Appendix F. Number of observations on the Superior National Forest for species not tested for trends in 2007. Includes flyovers and all birds regardless of distance.

Species	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Common Loon		2		13	11	39	25	34	37	62	53	24	40	38	21	15	30
Pied-billed Grebe							1				1	5			1	2	
American White Pelican							4										
American Bittern		1	4		2	18	9		1	3	3	13	14	4	13	1	2
Great Blue Heron			1											1		2	3
Green Heron										1							
Turkey Vulture					1			2			1			3	1		4
Canada Goose							1	1	2			26	7	2	2		2
Wood Duck	1									1	1						
American Black Duck													2	2			
Mallard				1		1	1	2	1	4	8	7	3		2		1
Blue-winged Teal			1														
Green-winged Teal												11					
Canvasback				1													
Ring-necked Duck												3					
Common Goldeneye												3	1		1		
Common Merganser										3		5	1	4		1	1
Osprey																1	
Bald Eagle										1		1					1
Sharp-shinned Hawk										1				1			3
Cooper's Hawk																1	
Red-shouldered Hawk										2							
Broad-winged Hawk	4	3	3	4	4	3	11	7	11	9	16	14	7	11	6	13	19
Red-tailed Hawk									1						1	1	1
American Kestrel			1			1			1		1	1	1				
Merlin										1	2					1	
Spruce Grouse		2								1			1	2			
Virginia Rail				1													
Sora		1										1					
Sandhill Crane								2									
Killdeer						4	1	3				2		1			
Solitary Sandpiper											1						
Common Snipe	1	1	1	10	5	18	5	5	5	16	9	10	5	18	9	5	17
American Woodcock		1					1							2			

Appendix F. Number of observations on the Superior National Forest for species not tested for trends in 2007. Includes flyovers and all birds regardless of distance.

Species	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Ring-billed Gull						3				12			1				
Herring Gull				1					6			2				2	
Mourning Dove										1	1		1				
Black-billed Cuckoo	3	12	2	3	1	5	5	4	4	23	45	10	11	7		30	47
Yellow-billed Cuckoo	1				2		1	3	1								
Great Horned Owl									1					2			
Northern Hawk Owl											1						
Barred Owl		1			1		5		5				1	1	1		4
Great Gray Owl	1														1		
Boreal Owl	1																1
Northern Saw-whet Owl	1																
Common Nighthawk		1	3			1			3	1				1		1	
Whip-poor-will				1		1							1				
Chimney Swift															3		2
Ruby-throated Hummingbird	2	6	6		1	2	4	4	2	8	4	8	7	4	10	6	10
Belted Kingfisher	1	2		4	2	5	1	2	2	4		3	5	1	1	2	2
Red-headed Woodpecker								1									
Red-bellied Woodpecker										1							
Downy Woodpecker	5	9	8	10	12	1		6	5	30	13	15	17	6	10	14	6
Black-backed Woodpecker									1	4	5	3	5	3	2	2	8
Pileated Woodpecker	8	6	8	14	16	19	4	7	20	34	65	32	78	64	42	37	67
Olive-sided Flycatcher	17	10	4		4	3	1	1	6	3	5	4	4	9	10	3	10
Eastern Phoebe	2	1			1	2			2	2	3	1	1	1	1	2	2
Great Crested Flycatcher	3	8	7	3	10	8	13	4	2	13	4	3	10	4	2	3	7
Eastern Kingbird	1	3	4		4	1		2	1			7	1	1	1		
Yellow-throated Vireo		1	1		2	5				4	1		3			1	
Warbling Vireo													1		1		
Philadelphia Vireo					1												
American Crow		1	2	18	14	34	72	57	53	99	72	69	103	75	21	33	37
Common Raven	3	5		18	20	29	67	40	28	69	101	78	65	60	34	58	38

Appendix F. Number of observations on the Superior National Forest for species not tested for trends in 2007. Includes flyovers and all birds regardless of distance.

Species	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Tree Swallow			2						2	1				2			
Northern Rough-winged Swallow													1				
Bank Swallow											1						
Barn Swallow											1						
Boreal Chickadee	1		1	1		1			1		2	3	6	8	5		7
White-breasted Nuthatch		10	5	11	1	6	3	1		5	1	3	13	3	4	3	
House Wren	2	1	2		4	2	1	1	3		1	1		2			1
Sedge Wren	4	2	1	6	4	2				3	1	2		9	2	3	3
Marsh Wren		1		2										1			
Eastern Bluebird	1											1		2		1	
Gray-cheeked Thrush			1														
Wood Thrush		3	2	4	5	7	6	5	12	11	9	3	9	4	4	3	3
Gray Catbird		1				3	1	1		6	1	2		1		2	
Brown Thrasher		2	1		1	3	2	1							1		
Yellow Warbler	2	7	2	20	6	1		1			1	2	3		1	1	
Palm Warbler (Western)		1	6	4		7	1	5	2		3	3			1		1
Bay-breasted Warbler		1		2	8	10			4								
Blackpoll Warbler					1												
Connecticut Warbler	14	13	17	19	13	14	13	21	1	13	13	9	4	6		2	5
Wilson's Warbler			2	1	1		1										
Eastern Towhee					1						1						
Clay-colored Sparrow				5			1	1				5	2	1	1	1	
Vesper Sparrow			1		2	6									1		1
Savannah Sparrow															1		
Lincoln's Sparrow	6	4	11	4	3	5	1	4	1	10	4	5		6	12	4	3
Dark-eyed Junco (Slate-colored)	2	5		15	9	5	2	3	2	1	9	1	5	2	1	3	8
Northern Cardinal						1											
Indigo Bunting	6		1	9			4	4	7	1	4	10	12	6	10	3	10
Red-winged Blackbird	14	4	6	7	7	13	13	7	2	18	11	20	19	10	9	13	6
Rusty Blackbird		5															
Brewer's Blackbird			5				1				1						

Appendix F. Number of observations on the Superior National Forest for species not tested for trends in 2007. Includes flyovers and all birds regardless of distance.

Species	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Common Grackle		4				3		2			6	8	4	1	1	7	1
Brown-headed Cowbird	9	3	2		3	3	1		7	1	1	4	4	1			
Baltimore Oriole	2		1	3		4	4	2	2	1	1	4	3				1
Red Crossbill							1			1	5			2	4	11	21
White-winged Crossbill						1		2		10	3	4	14	3	1		5
Pine Siskin			9	1	6	2	2		6	23	3	10	4	3	10	1	41
American Goldfinch	3	2	5	2	1	1	8	9	24	21	15	21	15	35	13	13	16
Evening Grosbeak	15	10	28	25	4	27	38	55	53	39	44	45	22	24	32	10	16