1998 Annual Update Report:

Breeding bird monitoring in Great Lakes National Forests: 1991-1998

Report to: Chequamegon/Nicollet, Chippewa and Superior National Forests

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REPORT FORMAT AND OBJECTIVES

The primary objective of this report is to update the Forests on results of the breeding monitoring program in the Great Lakes region. We will focus on the abundance trends of bird community parameters and individual species over the 4 to 8 year time frame of the monitoring. Our intent is to present a summary of the most important results and to provide detailed information in appendix form for those who may need more specific data. A manuscript that was published in The Loon is included which summarizes abundance trends up to 1997.

1998 BUDGET

Direct costs for the monitoring ($42,000) on the three National Forests was provided by the Washington office of the Forest Service. Money was allocated to the project after our proposal to the National Forest Foundation was not selected for funding. Indirect cost (14% of total federal cost) was paid by the three Forests. Bird surveys in the East Central and Southeast regions of Minnesota are part of the Minnesota Forest Bird Diversity Initiative which is funded by the Legislative Commission on Minnesota Resources. The annual cost to each Forest for the monitoring of one species that is abundant enough to detect trends ranges from $300/species in the Chippewa and Chequamegon to $440/species in the Superior National Forest.

SUMMARY

★ A total of 133, 162, and 128 stands (1,269 census points) were surveyed in the Chippewa, Superior and Chequamegon National Forests, respectively. Surveys have been completed for 8 years in the Chippewa and Superior and for 7 years in the Chequamegon.

★ One-hundred seventy census points were surveyed in East Central Minnesota over the past 7 years and 211 census points in Southeast Minnesota over the past 4 years.

★ A total of 74 species were abundant enough in at least one region to test for trends in annual abundance. Fifty species in the Chippewa National Forest, 45 species in the Superior National Forest, 50 species in the Chequamegon National Forest, 32 species in East Central Minnesota, and 38 species in Southeast Minnesota were tested.

★ The average number of species and individuals observed/stand or point in four of five study regions were at an all time high in 1998. In contrast, the lowest number of species and the second lowest numbers of individuals were observed in Southeast Minnesota in 1998 than in the previous three years.

★ In the Southeast Minnesota region 57% of the species tested showed a significant trend in abundance. In the other four regions, 84 to 98% of the species tested exhibited a significant trend in abundance.

★ Almost 30% of the species in Southeast Minnesota showed significant linear decreasing trends from 1995 through 1998 and an additional 19% had negative overall trends. Ten percent of the species in Southeast Minnesota had increasing abundance trends.

★ In contrast, in the other four regions more than 63% (63 to 74%) of the species have increased in abundance from 1991 (or 1992) to 1998. The percent of the species that have declined in the other regions ranged from 25% in the Superior National Forest to 12% in the Chippewa National Forest.

★ A total of 38 species showed significant decreases (linear or other) in at least one region. Of these, 22 species (59%) also increased significantly in another region. Fifteen species decreased in one or more regions without indicating increases in other regions. Ten species declined in one region and six species, the Downy Woodpecker, Golden-crowned Kinglet, Gray Catbird, Canada Warbler, Indigo Bunting and American Goldfinch declined in two regions.

★ About 64% (7 of 11) of the permanent residents tested showed a significant decrease in one region. The proportion of short distant migrants that declined was about 40% (9 of 22) of the total number tested and about 55% (22 of 40) of the long distant migrants tested decreased in abundance in one region.

★ When species were categorized by nest location, the largest proportion of species decreasing were cavity and canopy nesting species.

★ The proportion (all about 50%) of species declining within general habitat groups was almost equal across open, young forest, and forest habitat groups.

★ The spring of 1998 was affected by the El Nino weather pattern and was warmer than average in all regions. Precipitation was lower in April than normal, but wetter than normal in the other spring months. June in all regions was cooler and wetter than normal.

★ The warm spring in the Great Lake's area affected: 1) timing of permanent resident breeding which was earlier than normal, and 2) timing of short distance migrant arrival which was also earlier than normal. Arrival times of long distance migrants were not affected by local weather patterns.

★ We speculate that breeding of long distance migrants was also somewhat earlier in 1998. This is supported by the observations of more than the average number of fledglings during our late-June and early July survey dates.

★ It is also likely that more double brooding occurred in 1998 due to the favorable weather conditions, although we have no data to support this hypothesis.

★ Another potential reason for an increase in numbers of individuals in 1998 is also related to the warm spring weather and the theory of heterospecific attraction. Our data support this hypothesis: number of breeding migrants over the eight years of monitoring was highly correlated ($r=0.701$ and $p< 0.001$) with the number of foliage and bark gleaning insectivorous permanent residents. Specifically, in years where we observed the greatest numbers of Black-capped Chickadees, Red- and White-breasted Nuthatches and Blue Jays we also recorded the largest number of migrant individuals.

★ Four of the six species that decreased in abundance in more than one region (Gray Catbird, Canada Warbler, Indigo Bunting and American Goldfinch) are associated with early successional, edge, or shrub habitat.

★ Of the other two species that declined, the Downy Woodpecker occurs predominantly in mature deciduous forests and the Golden-crowned Kinglet is most abundant in mature lowland conifer habitat.

★ It is difficult to determine the exact cause of these species declines. However, more detailed studies may be required for these species if declines continue.

STUDY DESIGN

The study design we used for the national forest study areas is described in Hanowski and Niemi (1995). The difference in the design between the national forests and East Central Minnesota and Southeast Minnesota study areas is the sampling unit or area where bird surveys are conducted. The sampling unit for the three national forests is a forest stand of at least 40 acres (16 ha), the minimum size needed for three non-overlapping census points. Because the forest patches in East Central Minnesota and Southeast Minnesota are generally small (< 40 acres), only one census point could be placed in each stand. For these study areas, a stand had to be at least 10 acres (4 ha) in size. A total of 133, 162, and 128 stands (1,269 census points) were surveyed in the Chippewa, Superior, and Chequamegon National Forests, respectively. One-hundred seventy census points were surveyed in East Central Minnesota and 211 census points in Southeast Minnesota (Figure 1 and 2).

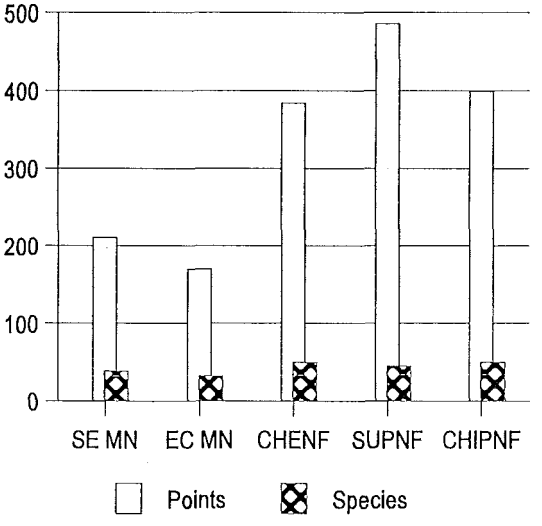

Figure 1. Summary of total points surveyed and number of species tested for abundance trends in each region.

We used ten-minute point counts to survey birds from June through early July (see Hanowski and Niemi (1995) for details on methods and observer training). This method is most effective for detecting singing passerine species. Because point counts are conducted in June or early July, this method may

underestimate the number of early nesting species that may not be singing as frequently during this time period. From 1991 to 1993, all birds heard or seen within 100 m of the point count center were recorded. In 1994, we changed our methods to include all birds heard or seen from the census point so that our results could be compared with other monitoring programs in this region (see Howe et al. 1997).

We estimated relative abundance for each species with a method (least-square estimates of means) that accounts for missing values from sites that were not sampled in any one year (e.g., rain during point count). Statistical analyses for trends were conducted for species observed on at least 10% of the stands in any year. A total of 74 species were abundant enough in at least one region to test for trends in annual abundance. Fifty species in the Chippewa National Forest, 45 species in the Superior National Forest, 50 species in the Chequamegon National Forest, 32 species in East Central Minnesota, and 38 species in Southeast Minnesota met this criteria. A repeated measures analysis of variance (ANOVA) was used to identify similarities and differences in bird abundance for each study area over the years of the monitoring program. Trends in abundance over time were either linear or categorized as other (e.g., quadratic, cubic or higher polynomials).

Figure 2. General locations of breeding bird point counts in five regions of Minnesota and Wisconsin.

RESULTS

The average number of species and individuals observed/stand or point in four of five study regions were at an all time high in 1998 (Figure 3 and 4). In contrast, the lowest number of species and the second lowest numbers of individuals were observed in the Southeast Minnesota study region in 1998 than in the previous three years (Figure 3 and 4). All trends by region for both species and individuals were linear.

The number of individual species that had significant trends in abundance was positively related to the number of years the surveys were conducted (see Figure 1). For example, in Southeast Minnesota 57% of the species tested showed a significant trend in abundance. This region has been monitored for the fewest number of years (four). In the other four regions, 84 to 98% of the species tested exhibited a significant trend in abundance (Figure 5).

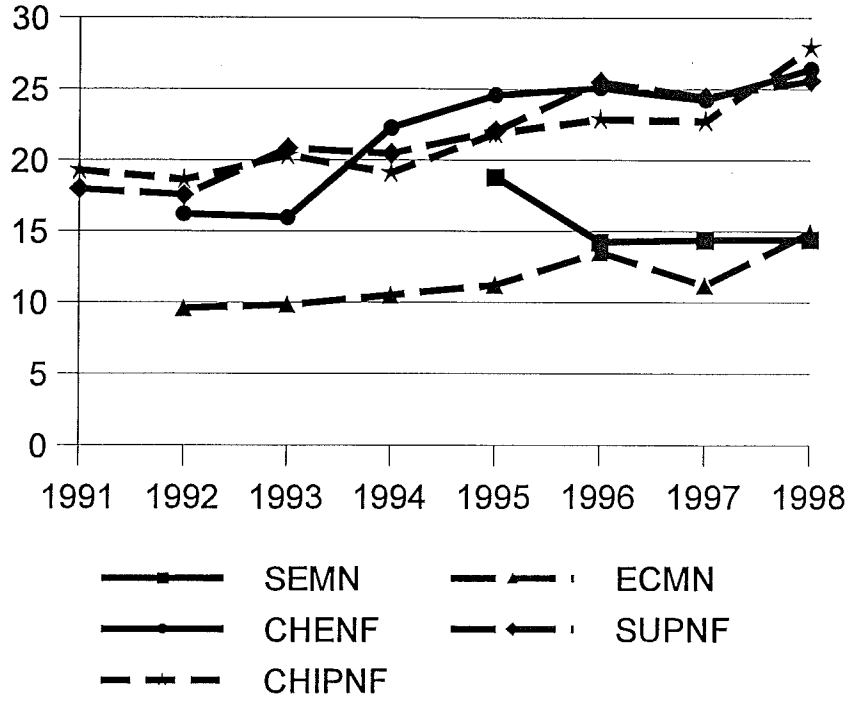

Figure 3. Average number of individuals/point in ECMN and SEMN or individuals/stand in the CHENF, CHIPNF and SUPNF from 1991 through 1998.

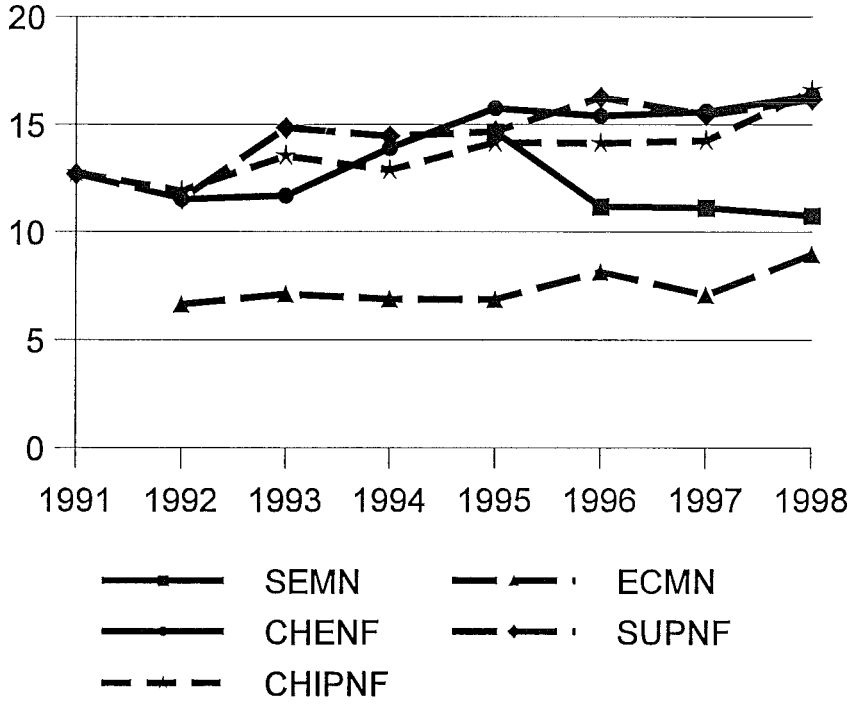

Figure 4. Average number of species/point in ECMN and SEMN or species/stand in the CHENF, CHIPNF and SUPNF from 1991 through 1998.

Table 1. Summary of species that indicated a significant decrease in abundance in any one region. Regions where the species increased, their habitat preference, migration strategy and nest location are indicated.

Species	Increase	Decrease	Habitat	Migrate	Nest
Ring-necked Pheasant		SE	open	perm	ground
Ruffed Grouse	CHEQ	SUP	forest	perm	ground
Wild Turkey		SE	forest	perm	ground
Red-bellied Woodpecker		SE	forest	short	cavity
Downy Woodpecker		CHIP SE	forest	perm	cavity
Hairy Woodpecker	CHEQ CHIP	SUP SE	forest	perm	cavity
Pileated Woodpecker		SE	forest	perm	cavity
Eastern Wood Pewee	CHEQ CHIP ECEN	SUP SE	forest	long	mid-canopy
Least Flycatcher	CHIP ECEN	CHEQ SUP	forest	long	mid-canopy
Great Crested Flycatcher	CHEQ	SE	forest	long	cavity
Gray Jay	SUP	CHIP	forest	perm	mid-canopy
Blue Jay	CHEQ CHIP SUP ECEN	SE	forest	perm	mid-canopy
Brown Creeper	CHIP SUP	CHEQ ECEN	forest	short	bark
House Wren		SE	young forest	long	cavity
Golden-crowned Kinglet		CHIP SUP	forest	short	mid-canopy
Ruby-crowned Kinglet		SUP	forest	short	mid-canopy
American Robin	CHEQ CHIP SUP SE	ECEN	forest	short	mid-canopy
Gray Catbird		ECEN SE	yng forest	long	low shrub
Solitary Vireo	CHIP SUP	CHEQ	forest	long	mid-canopy

Species	Increase	Decrease	Habitat	Migrate	Nest
Yellow-throated Vireo	CHEQ CHIP ECEN	SE	forest	long	mid-canopy
Red-eyed Vireo	CHEQ CHIP SUP ECEN	SE	forest	long	mid-canopy
Golden-winged Warbler	CHIP	SE	yng forest	long	low shrub
Nashville Warbler	CHEQ CHIP SUP	ECEN	yng forest	long	ground
Black-throated Green Warbler	CHEQ SUP	CHIP ECEN	forest	long	mid-canopy
Black-and-white Warbler	CHIP	CHEQ SUP ECEN	forest	long	ground
Common Yellowthroat	CHEQ CHIP SUP	SE	yng forest	long	low shrub
Canada Warbler		CHEQ SUP	forest	long	low shrub
Northern Cardinal		SE	forest	perm	low shrub
Rose-breasted Grosbeak	CHEQ CHIP SUP ECEN	SE	forest	long	mid-canopy
Indigo Bunting		CHEQ ECEN	yng forest	long	low shrub
Song Sparrow	ECEN	SUP	yng forest	short	low shrub
Dark-eyed Junco		CHEQ	forest	short	ground
Red-winged Blackbird		SE	yng forest	short	low shrub
Brown-headed Cowbird	CHEQ ECEN	CHIP SE	forest	short	parasite
Purple Finch	CHEQ	CHIP SUP	forest	short	mid-canopy
American Goldfinch		CHEQ SUP	yng forest	short	low shrub
Evening Grosbeak	SUP	CHEQ	forest	short	mid-canopy

Almost 30% of the species in Southeast Minnesota showed significant linear decreasing trends from 1995 through 1998 and an additional 19% had negative overall trends (Figure 5). Ten percent of the species in Southeast Minnesota region had increasing abundance trends (Figure 5). In contrast, in the other four regions more than 63% (63 to 74%) of the species have increased in abundance from 1991 (or 1992) to 1998. The percent of the species that have declined in the other regions ranged from 25% in the Superior National Forest to 12% in the Chippewa National Forest.

A total of 38 species showed significant decreases (linear or other) in at least one region (Table 1). Of these, 22 species (59%) also increased significantly in another region. Fifteen species decreased in one or more regions without indicating increases in other regions. Ten declined in one region and six species the Downy Woodpecker, Golden-crowned Kinglet, Gray Catbird, Canada Warbler, Indigo Bunting and American Goldfinch declined in two regions (Table 1).

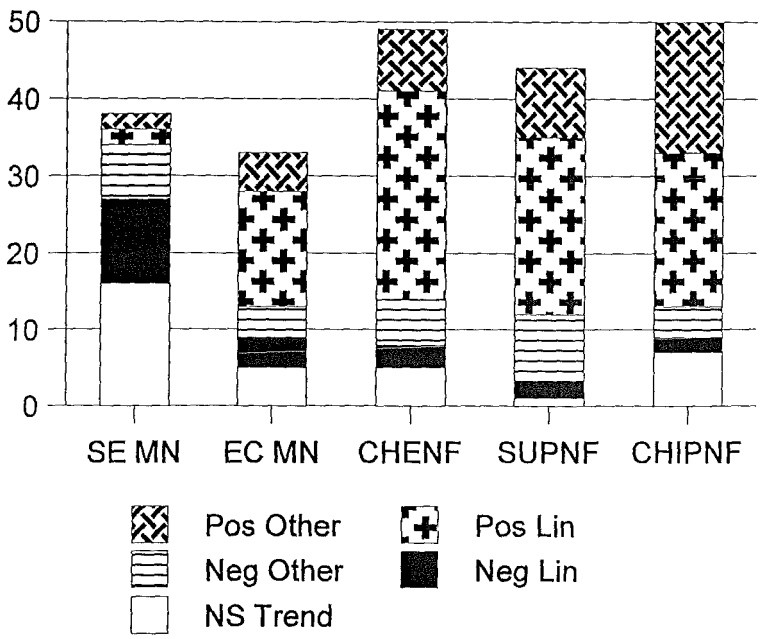

Figure 5. Summary of number of species within each region with positive, negative or no significant abundance trend. SE MN monitoring was from 1995-1998, ECMN and CHENF was from 1992-1998 and SUPNF and CHIPNF was from 1991-1998.

Examination of the proportion of all species within migration categories that decreased indicated that 67% of the permanent residents tested showed a significant decrease in one region. The proportion of short distance migrants that declined was about 40% of the total number tested and about 54% of the long distance migrants tested decreased in abundance in one region (Figure 6). When species were categorized by nest location, the largest proportion of species decreasing were cavity and canopy nesting species (Figure 6). The proportion of species declining within general habitat groups was almost equal across open, young forest, and forest groups (all about 50%) (Figure 6).

The largest number of permanent resident species that decreased occurred in Southeast Minnesota region (Figure 6). This region also had the most long distance migrant species that indicated a decrease in abundance. The relative number of long and short distance and permanent resident species that declined in other regions was evenly distributed across the migration types (Figure 6).

If species that are decreasing in abundance are examined by nest position or type and region, we find a general pattern that reflects the pattern found for migration strategy. For example, because many permanent residents also nest in cavities, numbers of cavity nesting species that declined is highest in Southeast Minnesota region. We did not find patterns that indicated that low or ground nesting species were more likely to show a decrease compared to species that nest in the canopy (Figure 7). In contrast, the most species that decreased in the Superior and Chippewa National Forests were those that nest in trees (Figure 7).

Species that prefer forests were more likely to decrease than species that nest in young forests or open habitats (Figure 8). This trend was evident in all regions.

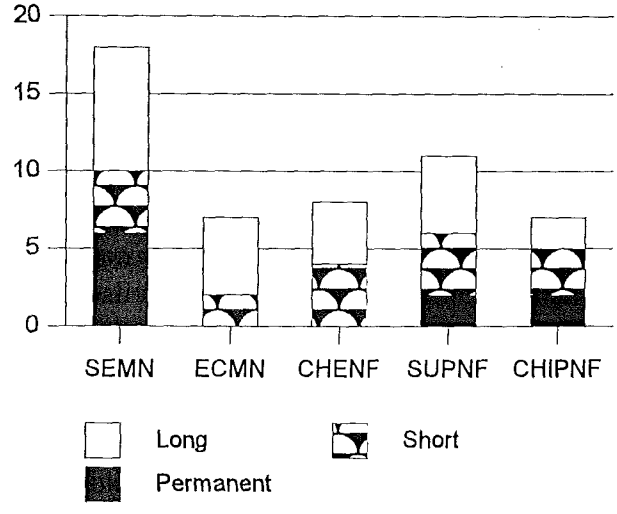

Figure 6. Number of species declining in each region by migration strategy.

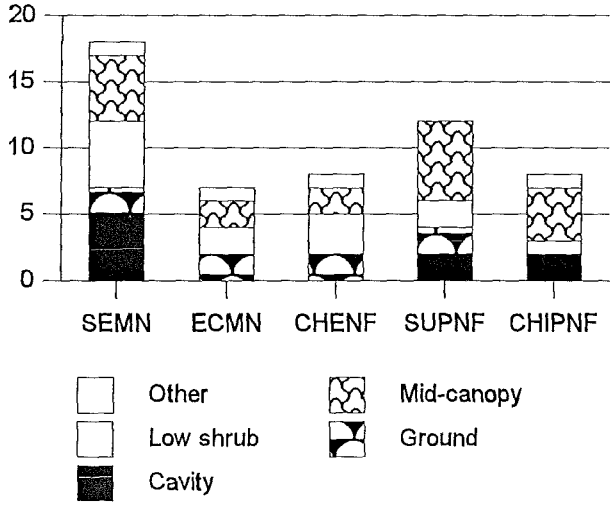

Figure 7. Number of species declining in each region by nest position or type.

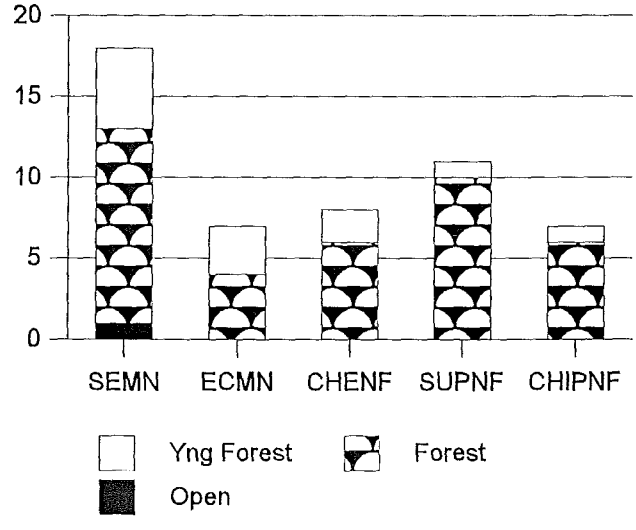

Figure 8. Number of species declining in each region by general habitat preference.

DISCUSSION

Bird populations in northern forest regions of Minnesota and Wisconsin were at an all time high in 1998 in comparison with all previous years of the monitoring. Populations in Southeast Minnesota continued to decline since the beginning year of our monitoring in that region. Increases in the north may be attributed to several possible reasons including weather, heterospecific attraction, and initial abundance values. Decreases in the south are troublesome and may indicate that bird populations for many species in this region are sink populations.

The spring of 1998 was affected by the El Nino weather pattern and was warmer than average in all regions (Figure 10). Precipitation was lower in April than normal, but wetter than normal in the other spring months (Figure 9). June in all regions was cooler and wetter than normal. The warm spring in the Great Lake's area affected: 1) timing of permanent resident breeding which was earlier than normal, and 2) timing of short distance migrant arrival which was also earlier than normal. Arrival times of long distance migrants were not affected by local weather patterns. This was not unexpected because these individuals travel long distances from Central and South America and their migration timing is affected primarily by photo period. Favorable weather conditions in May likely accelerated movements of these individuals across the United States. Many people noticed a lack of migrants in their regions during this time period. We speculate that breeding of long distance migrants was also somewhat earlier in 1998. This is supported by the observations of more than the average number of fledglings during our late-June and early July survey dates. It is also likely that more double brooding occurred in 1998 due to the favorable weather conditions, although we have no data to support this hypothesis.

Another potential reason for an increase in numbers of individuals and species in 1998 is also

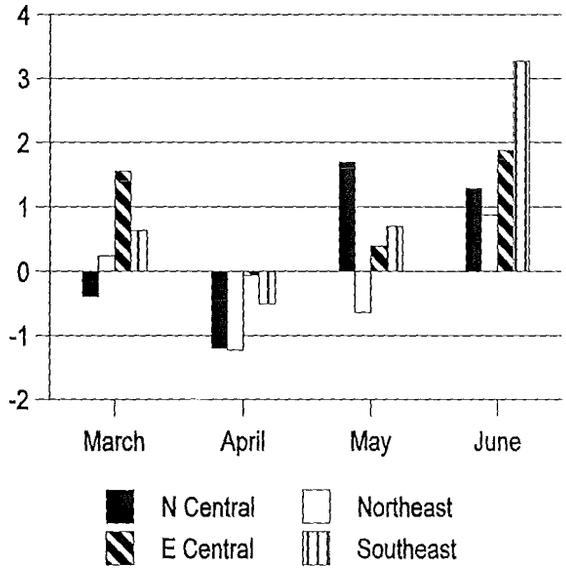

Figure 9. Departures from normal precipitation in four regions in Minnesota during March, April, May and June 1998.

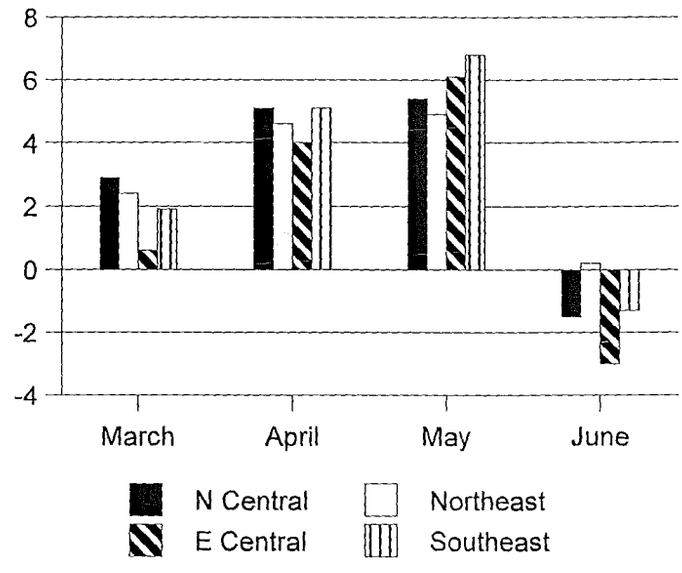

Figure 10. Departures from normal temperatures in four regions in Minnesota during March, April, May and June 1998.

related to the warm spring weather and the theory of heterospecific attraction (Monkkonen et al. 1996). 1997). Experimental studies conducted in northern Minnesota and Finland have demonstrated that breeding populations of migrants are positively influenced by local populations of resident birds. Our data support this hypothesis, that is the number of breeding migrants over the eight years of monitoring is highly correlated ($r=0.701$ and $p< 0.001$) with the number of foliage and bark gleaning insectivorous permanent residents (Figure 11). In years with warm spring weather permanent resident species nest earlier in the season. Earlier nesting by these species increases the number of individuals in an area because it is likely that young birds would be completely mobile by the time the migrant species arrived on the breeding area.

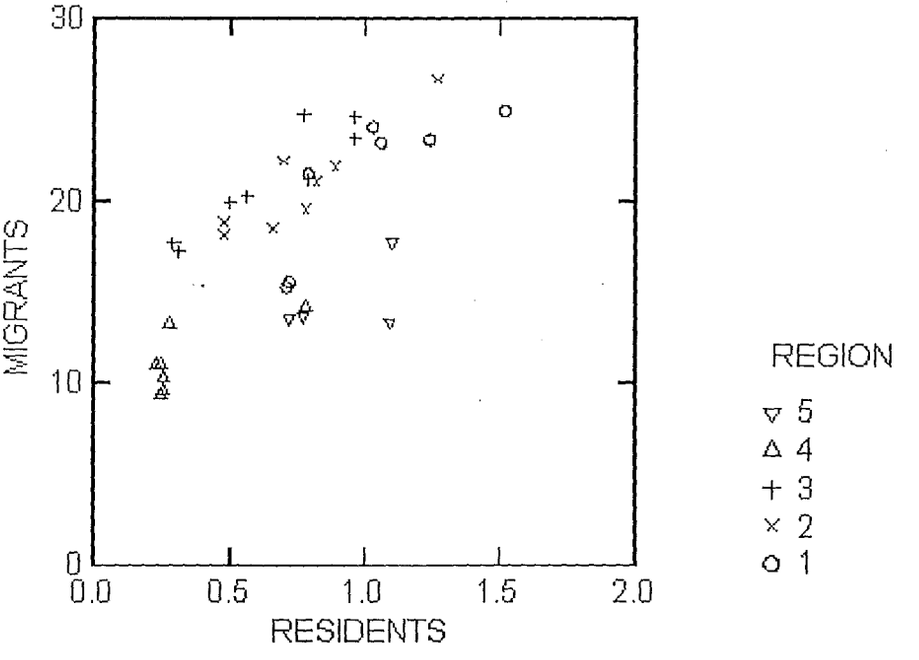

Figure 11. Relationship between number of resident individuals and migrant individuals for each year of monitoring in five regions (1=CHENF, 2=CHIPNF, 3=SUPNF, 4=ECMN, 5=SEMN)

DECLINING SPECIES OF CONCERN

The Downy Woodpecker is a permanent resident species in all regions of our study and is associated with deciduous forest habitat. This species decreased significantly in the Chippewa National Forest and in Southeast Minnesota. This species is a primary cavity nesting bird that is found most abundantly in lowland deciduous forest type in the Chippewa National Forest. It also occurs in many other habitats and does not have a preference for a single type in the Chippewa (personal data). It prefers trees with heartrot and a diameter of 15 to 25 cm d.b.h. (Evans and Connor1979) and requires 320 to 400 dead trees/40 ha to maintain good populations. Based on Breeding Bird Survey (BBS) trends for Minnesota, the species has not changed in abundance over the past 26 years. The BBS however, has lower power and therefore less chance in detecting trends in species abundance than our regional monitoring program. There does not seem to be an obvious reason for the decline of this species in our study regions.

The Golden-crowned Kinglet is a short distance migrant that is associated with conifer habitats. It declined in both of northern Minnesota's National Forests. Our habitat association information indicate that it reaches highest abundance in lowland conifer forest in the Chippewa National Forest and does not occur in deciduous forest types. In the Superior National Forest, the species is also found most abundantly in lowland conifer. It also occurs in mixed conifer/deciduous habitats, but at an abundance that is significantly lower than in lowland conifer (personal data). This species has no calculated BBS trend in Minnesota because it is not recorded on enough routes. Due to this species association with lowland conifer forest and the time that is required to regenerate this habitat, it may be possible that declines are linked to changes in habitat age structure over time. Another possible explanation for the decline may be attributed to dramatic changes in habitat in the wintering areas in the southern United States.

The Gray Catbird decreased significantly in Southeast and East Central regions of Minnesota. This species is associated with early successional, wet shrub, and edge habitats. In East Central Minnesot, the species occurs most commonly in early successional aspen (personal data). Due to the birds size, it is likely not a common host species for the Brown-headed Cowbird (Scott 1977), but could be susceptible to nest predation because it nests in shrubs and close to edges (Nickell 1965). The species has a nonsignificant abundance trend in Minnesota based on BBS. The species decline in our two study regions, which are the most highly fragmented forest areas of the five study regions, may be attributed to high populations of predators in these areas. Another concern, is that this species relies on berry-producing shrubs for food. If forest ecosystems become more simplified and fruit-bearing trees and shrubs are not maintained, populations of this species may be reduced.

Another species that has declined in two regions of study is the Canada Warbler. This species is a long distance migrant that is associated with forests, but nests along edges or within gaps in forest habitats. It is a shrub nester and has decreased in the Superior and Chequamegon National Forests. This species occurs in highest abundance in older aspen forests in the Superior National Forest, but also is frequently found in regenerating mixed forest, paper birch, mixed upland forest, and mixed swamp conifer (personal data). In the Chequamegon, it is most abundant in lowland deciduous and upland mixed

forest types (personal data). In Minnesota, this species has not shown any significant change in abundance based on BBS. Reasons for the species decline in our regions of study are not clear.

The Indigo Bunting is another species of concern, having declined in both the Chequamegon National Forest and East Central Minnesota. This species is associated with early successional forests and edges. Based on our habitat information it reaches highest abundance in upland brush habitat in the Chequamegon National Forest and also occurs in pine plantations, especially along edges. In East Central Minnesota, it does not have a significant habitat association, but is found in greatest numbers in oak forests (personal data). Like the Gray Catbird, American Goldfinch and Canada Warbler it nests in shrubs and has an affinity for edges (Hanowski 1991). The BBS trend for the Indigo Bunting supports our data, the species has decreased significantly in Minnesota. This species, like the Gray Catbird may be susceptible to nest predation because it nests in shrubs and often along edges. It is also a common host to the Brown-headed Cowbird (Ehrlich et al. 1988). These factors, rather than a change in habitat available are likely reasons for the decrease in abundance of this species in our areas of study.

Another species of concern is the American Goldfinch. This species has declined in abundance in the Chequamegon and Superior National Forests. This species is also associated with early successional habitat, is a short distance migrant and nests in shrub vegetation. Based on our habitat information, it prefers early successional habitat in Superior National Forest and upland brush habitat in the Chequamegon National Forest. Based on BBS, the species has no significant trend in Minnesota. There may be several reasons for the decline we observed including the timing of breeding, which is somewhat dependent upon local food sources but most often occurs in mid-July (at the end of our surveys). This species nests in shrubs and along edges which may make it more susceptible to nest predation and parasitism by the Brown-headed Cowbird.

It is difficult to determine at this time the reasons for these species declines. One common life history trait that four of the six species share is their nest location (shrubs). Shrub density in forested landscapes is often higher along edges. These species occur more commonly in edge areas and may be more susceptible to both predation and nest parasitism. More detailed studies will be required if these species continue to decline in our study area.

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