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ABSTRACT

A one-day-a-week general bird-netting operation has been conducted each autumn since 1965 at the UWM Field Station. Overall results for 23 years are presented, on a species by species basis. The 101 species captured were divided into three groups for a linear regression test for long-term population trends. Permanent residents showed no change over the 23 years. Short distance migrants exhibited a slight but not statistically significant decline. Long-distance migrants, on the other hand, exhibited a statistically significant decline, lending support to other studies which have reported population declines in North American songbirds that spend the winter in the tropics.

INTRODUCTION

Each autumn since 1965 I have conducted a general bird netting and banding program at the UWM Field Station. Initially my attention was focused on the annual physiological cycles of the Ovenbird, a summer breeding resident in the area, and the Dark-eyed Junco, a winter resident. It turned out that general netting was an efficient way of gathering information on these species in the fall. Later, when my attention turned to the Black-capped Chickadee, it still seemed to be the best way of obtaining data on chickadee numbers, movements and flock composition.

What kinds of information can general netting programs provide? Bird-banding in North America is regulated, supervised and coordinated by the U.S. Fish and Wildlife Service and its companion agencies in Canada, Mexico and other countries. All banders submit detailed records for entry into the computerized data-bank of the U.S.F.W. Bird-Banding Laboratory. The primary objectives are to determine survival, mortality, longevity, dispersal movements and migratory movements of individual birds and populations, and to detect geographic and temporal variations in such phenomena, with the ultimate goal of conservation or management of bird populations. Individual scientists make further use of banding in detailed studies of seasonal and daily physiological changes (Weise 1970), territoriality, social organization (Ficken 1982, Weise 1971), social behavior and communication (Ficken 1982), and many other aspects of bird life.

The present paper deals with one further use of netting and banding data, the determination of long-term trends in bird populations. Over the last decade many ornithologists have become concerned about apparent declines in the numbers

of many songbird species, including some of the most attractive and characteristic components of the North American avifauna such as the wood warblers. More specifically, the declines appear to be greatest in species that winter in the tropical or subtropical regions of Central and South America. The evidence for such declines comes from a variety of kinds of bird censuses and surveys and is complicated and equivocal. It is by no means certain that the perceived declines are real.

METHODS

The general netting operation runs from late August to early November. Nets are set one day a week (usually Saturday) for the entire day, barring unfavorable weather. We usually use 10-15 Japanese mist-nets (12 m long, 2 m high, 4 shelf, 36 mm mesh size) set in favorable locations such as forest edges, stream courses or lines of vegetation - places where songbirds tend to be concentrated as they feed and move about during the day. We use the same net locations each year. These nets are most efficient for birds of warbler-sparrow-thrush size, but will frequently catch birds as large as flickers or Sharp-shinned Hawks. Once or twice each year we set these and larger-mesh nets overnight to catch owls.

From 1965 to 1970 we netted in only one area, the edges of the upland forest and swamp forest west of the laboratory building. Since 1971 we have rotated the netting area on a weekly basis among three areas. Area A is the original area west of the lab. Area B is along the edges of Cedarburg Bog and Area C is along the boardwalk that extends out into the center of the bog. Thus each area is netted on three or four days during the fall season. This rotation is done to provide more extensive monitoring of the chickadee population, which still is the first priority in our operation. Comparison of the total bird captures in the three areas by a Percent Similarity Test showed that overall there is little difference between areas in the species composition of the catch.

Mist-netting, like any other trapping method, is species-selective. Nevertheless, it is well known that during autumn migration, small birds of most species concentrate in shrubby and weedy locations, and mist nets in such locations will catch representative numbers. The most notable exceptions are grassland or other open-country birds. In our case, we also miss some of the July and August migrants such as Yellow Warblers or Mourning Warblers.

Captured birds are taken to the lab, banded with U.S. Fish and Wildlife Service numbered aluminum bands, examined and released. In the examination, age (whether hatched in current year or some previous year) is determined by plumage and molt characteristics or by degree of skull ossification, detected by looking with a dissecting microscope through the skin (which is thin and transparent in small birds). The sex of the bird is determined by details of plumage or by measurements with ruler or calipers of wing chord, tarsus, bill or other body

parts. Such measurements also provide information on individual variation in size. The examination also includes data showing daily and annual physiological changes in birds: the amount of fat stored in deposits under the skin; the total body weight; the occurrence of molt (feather replacement) and its intensity and progress; the development or regression of the cloacal protuberance in males or the incubation patch in females, both of which are related to the breeding condition of the bird. Finally the time and net-location of capture are recorded.

RESULTS AND DISCUSSION

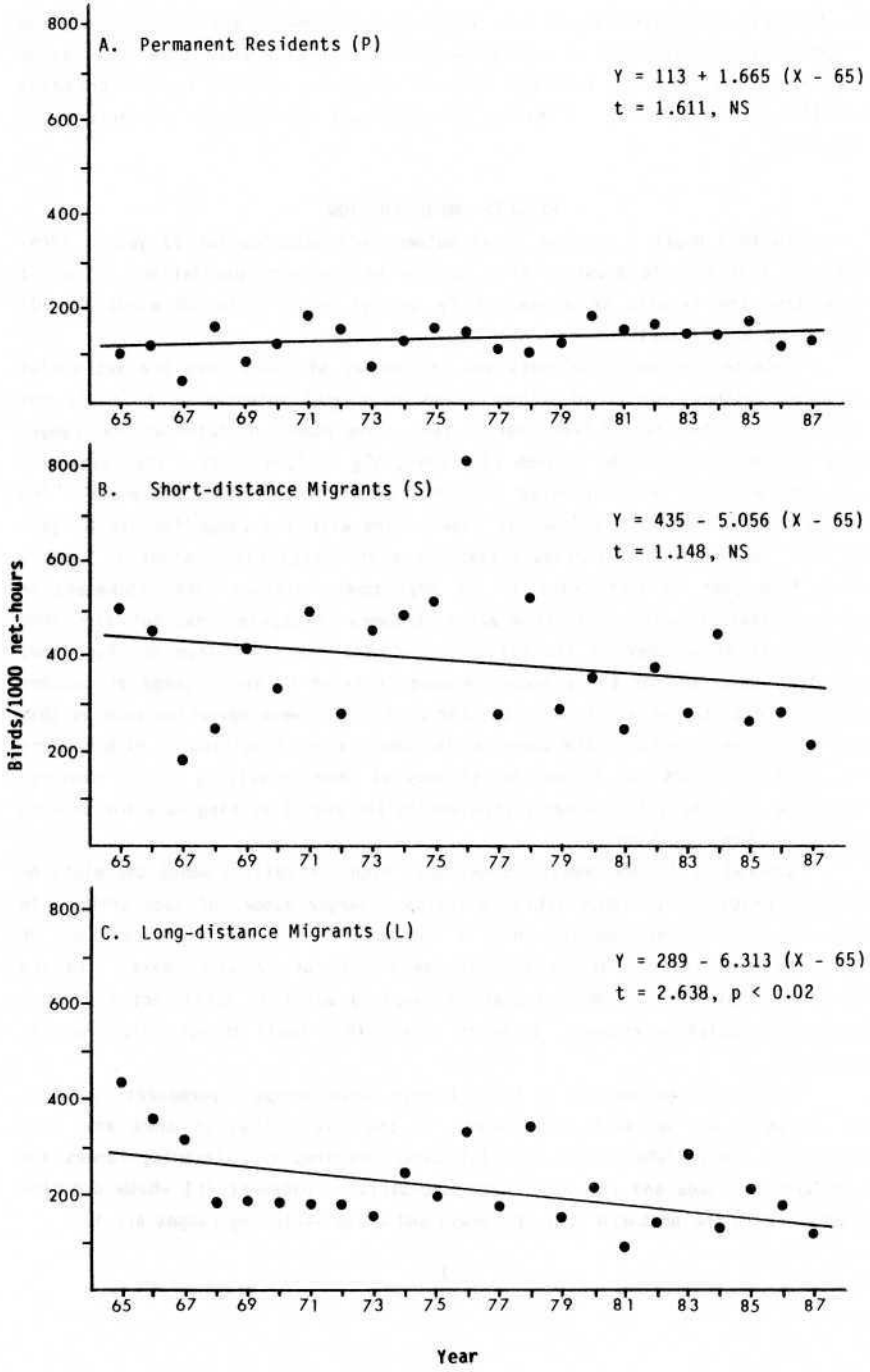
In this paper I use the total autumn bird captures for 23 years, 1965-1987, to test for the presence of a decline in song bird populations. Table 1 summarizes the results on a species by species basis: 18,159 birds of 101 species have been captured.

Because the number of nets and the number of hours they are set varies with the weather, number of helpers, and occasional absences on my part, the netting effort has varied from year to year. The number of net-hours has ranged from 431 in 1967 to 1,580 in 1986 ($\bar{X}$ = 1099, $SE_{\bar{X}}$ = 67, n = 23). The abundances for each year are best expressed as number of birds per 1,000 net-hours. The mean abundance for each species is shown along with the range for the 23 year period. The range column reveals that there are large fluctuations in capture rates from year to year, even in the most common species like chickadees or juncos. These result partly from actual changes in populations, but also from the effects of weather on the efficiency of the nets, and from the fact that migratory movements of birds occur in waves related to the passage of weather systems across the area. In a given year a one-day-a-week operation such as this may "hit" many or most of the waves during the season, resulting in high numbers per 1,000 net-hours, or it may "miss" many of them, resulting in low numbers. These are inherent and formidable problems in the use of netting data for showing population sizes in birds.

Generally, in any sampling procedure, high variability among the plots or sampling units can be compensated by having a larger number of such units. In this case, since the sampling unit is the total for a year, the only way of achieving this is to continue the program for 10 or 20 more years. In the meantime I make the assumption that 23 sampling units is sufficient to detect prominent population changes, although slower (but real) changes might not be detected.

I divided the species in Table 1 into three groups: permanent residents (P) in which all or most individuals in the Field Station area are non-migratory; short-distance migrants (S) whose breeding and wintering ranges are both within Canada and the U.S.; and long-distance migrants (L) whose breeding ranges are in the northern U.S. or Canada and whose wintering ranges are in

Figure 1. Trends in autumn mist-net catches, 1965-1987.



Central or South America or the West Indies. The collective data for each group were then plotted against year (Figure 1) and a linear regression test was performed. The lines of best fit are shown.

For the permanent residents there was little apparent change over the years. The slope of the line is 1.665, not statistically different from 0, which would be a horizontal line. For the short-distance migrants the line does have a slight negative slope, -5.056 but it is not statistically different from 0. One must conclude that there is no clear evidence of a long-term decline in these species, although more years of data might change this judgment.

On the other hand, the long-distance migrants do show a statistically significant long-term decline. The slope of the line is -6.313, i.e. the number of birds per 1,000 net-hours is declining at the rate of 6 per year. At this rate, no long-distance migrants will be left by the year 2011.

While this prediction is (I hope) too pessimistic, I have to conclude that the results of this study lend support to the belief that birds wintering in the tropics are declining, and quite rapidly. The causes of the declines are still conjectural. Biologists familiar with the American tropics blame large-scale deforestation and the widespread use of synthetic pesticides, including many, like DDT, which are banned in the U.S. because of their effects on birds and other wildlife. Many conservation organizations including The Audubon Society, Nature Conservancy, Natural Resources Defense Council, Environmental Defense Fund and others are developing strong programs to combat these problems in the tropics. Their efforts should be supported.

Table 1. Birds mist-netted in autumn (Aug. 20 - Nov. 10), 1965-1987.

Species[a]	Migratory Status[b]	Total caught (23 yrs.)	No. of years of Capture	Birds/1000 net-hrs./yr.[c] Mean	$SE_{\bar{x}}$	Range (rounded)
Sharp-shinned Hawk	S	19	9	.70	.25	0 - 5
Broad-winged Hawk	L	1	1	.03	--	0 - 1
Ruffed Grouse	P	1	1	.04	--	0 - 1
American Woodcock	S	7	7	.24	.08	0 - 1
Black-billed Cuckoo	L	30	12	1.40	.45	0 - 9
Yellow-billed Cuckoo	L	2	2	.07	--	0 - 1
Eastern Screech Owl	P	3	3	.13	--	0 - 1
Great Horned Owl	P	1	1	.03	--	0 - 1
Barred Owl	P	3	2	.10	--	0 - 2
Long-eared Owl	S	3	3	.10	--	0 - 1
Northern Saw-whet Owl	S	41	14	2.18	.53	0 - 6
Ruby-throated Hummingbird	L	27	12	1.00	.31	0 - 9
Red-bellied Woodpecker	P	4	2	.14	--	0 - 2
Yellow-bellied Sapsucker	S	7	5	.23	--	0 - 1
Downy Woodpecker	P	158	23	6.20	.62	2 - 12
Hairy Woodpecker	P	41	17	1.67	.30	0 - 5
Northern Flicker	S	45	17	1.70	.28	0 - 4
Eastern Wood-pewee	L	23	12	.83	.26	0 - 5
Yellow-bellied Flycatcher	L	62	20	2.71	.62	0 - 14
Acadian Flycatcher	L	1	1	.03	--	0 - 1
Traill's Flycatcher (Willow/alder)	L	21	11	1.18	.45	0 - 9
Least Flycatcher	L	80	21	3.85	.82	0 - 19
Eastern Phoebe	S	2	2	.10	--	0 - 2
Great Crested Flycatcher	L	5	4	.20	--	0 - 2
Blue Jay	S	113	20	4.42	.68	0 - 10
Black-capped Chickadee	P	2581	23	98.10	7.49	28 - 163
Red-breasted Nuthatch	S	34	10	1.10	.39	0 - 7
White-breasted Nuthatch	P	23	14	.91	.25	0 - 5
Brown Creeper	S	176	21	6.36	.86	0 - 16
House Wren	S	180	22	7.33	1.03	0 - 15
Winter Wren	S	36	15	1.32	.28	0 - 5
Marsh Wren	S	3	3	.11	--	0 - 1
Golden-crowned Kinglet	S	1031	22	36.67	6.92	0 - 151
Ruby-crowned Kinglet	S	900	23	34.70	2.99	11 - 84
Blue-gray Gnatcatcher	S	1	1	.03	--	0 - 1
Veery	L	33	16	1.23	.06	0 - 4
Gray-cheeked Thrush	L	268	23	12.44	2.12	4 - 42

Table 1., continued

Species[a]	Migratory Status[b]	Total caught (23 yrs.)	No. of years of Capture	Birds/1000 net-hrs./yr.[c] Mean	$SE_{\bar{x}}$	Range (rounded)
Swainson's Thrush	L	729	23	32.29	4.37	7 - 102
Hermit Thrush	S	760	23	29.28	2.85	10 - 61
Wood Thrush	L	23	14	.98	.26	0 - 5
American Robin	S	256	21	9.44	2.02	0 - 35
Gray Catbird	L	456	23	19.55	3.04	3 - 65
Brown Thrasher	S	5	4	.02	--	0 - 1
Cedar Waxwing	S	42	12	1.64	.56	0 - 11
Northern Shrike	S	2	1	.07	--	0 - 2
Solitary Vireo	S	12	10	.47	.12	0 - 2
Yellow-throated Vireo	L	5	5	.17	--	0 - 1
Warbling Vireo	L	1	1	.04	--	0 - 1
Philadelphia Vireo	L	131	22	6.17	1.29	0 - 19
Red-eyed Vireo	L	276	23	11.30	1.63	2 - 33
Blue-winged Warbler	L	5	4	.16	--	0 - 1
Golden-winged Warbler	L	33	14	1.27	.33	0 - 6
Tennessee Warbler	L	632	23	24.66	4.98	3 - 99
Orange-crowned Warbler	S	46	15	1.73	.42	0 - 7
Nashville Warbler	L	113	20	4.86	.90	0 - 15
Northern Parula	L	6	5	.22	--	0 - 1
Yellow Warbler	L	1	1	.03	--	0 - 1
Chestnut-sided Warbler	L	103	21	3.96	.74	0 - 16
Magnolia Warbler	L	671	23	26.65	2.40	12 - 51
Cape May Warbler	L	47	14	1.56	.51	0 - 9
Black Throated Blue Warbler	L	42	19	1.83	.31	0 - 5
Yellow-rumped Warbler	S	1229	23	38.73	9.86	4 - 192
Black-throated Green Warbler	L	86	22	3.40	.48	0 - 9
Blackburnian Warbler	L	4	4	.14	--	0 - 1
Pine Warbler	S	1	1	.03	--	0 - 1
Palm Warbler	S	28	13	1.24	.38	0 - 7
Bay-breasted Warbler	L	62	17	2.42	.67	0 - 13
Blackpoll Warbler	L	230	23	9.23	1.71	3 - 41
Black-and-white Warbler	L	72	23	2.98	.41	1 - 9
American Redstart	L	325	23	12.72	1.69	4 - 33
Ovenbird	L	321	23	14.30	2.88	2 - 66
Northern Waterthrush	L	49	17	2.05	.48	0 - 9
Connecticut Warbler	L	32	15	1.27	.29	0 - 4
Mourning Warbler	L	16	10	.53	.15	0 - 2
Common Yellowthroat	S	641	22	24.76	2.31	0 - 47

Table 1., continued

Species[a]	Migratory Status[b]	Total caught (23 yrs.)	No. of years of Capture	Birds/1000 net-hrs./yr.[c] Mean	$SE_{\bar{x}}$	Range (rounded)
Wilson's Warbler	L	11	9	.37	.11	0 - 2
Canada Warbler	L	27	13	1.14	.29	0 - 4
Scarlet Tanager	L	13	8	.81	.41	0 - 9
Northern Cardinal	P	56	19	2.20	.38	0 - 6
Rose-breasted Grosbeak	L	81	22	3.70	.72	0 - 16
Indigo Bunting	L	29	8	1.88	.80	0 - 14
Rufous-sided Towhee	S	6	5	.22	--	0 - 1
American Tree Sparrow	S	246	20	11.45	2.44	0 - 40
Chipping Sparrow	S	1	1	.03	--	0 - 1
Field Sparrow	S	24	15	.83	.18	0 - 3
Vesper Sparrow	S	1	1	.03	--	0 - 1
Savannah Sparrow	S	2	1	.20	--	0 - 5
Fox Sparrow	S	253	22	10.63	1.55	0 - 28
Song Sparrow	S	453	23	23.85	6.61	2 - 124
Lincoln's Sparrow	L	68	16	3.73	1.07	0 - 21
Swamp Sparrow	S	529	23	20.46	4.37	1 - 90
White-throated Sparrow	S	515	23	21.51	3.23	4 - 67
White-crowned Sparrow	S	5	4	.33	--	0 - 4
Dark-eyed Junco	S	1826	23	73.36	10.66	2 - 155
Rusty Blackbird	S	4	1	.14	--	0 - 3
Common Grackle	S	4	2	.14	--	0 - 2
Northern Oriole	L	4	3	.13	--	0 - 2
Purple Finch	S	52	11	2.08	1.19	0 - 27
Common Redpoll	S	7	2	.27	--	0 - 6
Pine Siskin	S	24	3	.79	--	0 - 11
American Goldfinch	P	459	23	20.83	5.24	2 - 99
101 species		18159				

a. Standard common names from AOU Checklist of North American Birds, 1983.

b. Abbreviations: P = permanent resident (majority of individuals non-migratory)
S = short-distance migrants (wintering within United States)
L = long-distance migrants (wintering in Central or South America)

c. Averaged over all years (n = 23) Net-hours varied from 431 in 1967 to 1580 in 1986, Total 24,971.

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