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FURTHER NOTES ON PURPLE FINCHES

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The four seasons that I have worked in Hillsboro, N. C., showed an alternation of high and low populations of Purple Finches. The attempt to find out whether this represented a real variation in numbers led up to various points in methodology which may be useful to others and to more conclusions than seemed possible in the beginning from a period as short as four years and the handling of only 469 birds.

The basic statistics for each season are shown in Table I. The term "percent of returns" refers to returns from the total of birds banded up to that season using that total as a base. The "adjusted population" is calculated by using an annual "survival" rate of 40 percent. This, of course, is not a real survival rate, but is unity minus a loss rate. The loss rate is made up of a true mortality rate and a rate of non-return of transmigrants (Blake 1959). This latter rate must be very nearly 100 percent based on the transmigrants but far smaller when based on the whole population. On rather uncertain grounds this loss rate has been taken to be 60 percent as a first approximation. Obviously this is an estimate of the population available to provide returns.

The first conclusion that can be reached is that the differences in the numbers present in the successive seasons do not imply corresponding differences in the real size of the population. If the total population were rising and falling numerically, one would expect the number of returns from the bandings of any given year to decline regularly because a true increase would be solely derived from reproduction. Actually the 117 birds banded during the winter of 1957-58 yielded in the three succeeding winters, 3, 12, and 1 returns respectively.

We may further conclude that most individuals do not have single, fixed winter residences. This leaves open the question of whether some individuals do have such single residences and also whether the rest have a few such used in different winters or whether the winter residence is entirely a matter of chance. The proportion of returns suggests that the residence in a given winter is not entirely determined by chance.

To see whether the variation noticed in the first paragraph was more than merely local, I examined first the last five Christmas Counts in "Audubon Field Notes," i.e. the seasons of 1956-57 to 1960-61 (See Table II).

Table I

Banding and return data

Seasons	57/8	58/9	59/60	60/1	61/2
New Bandings	117	6	323	21	
Returns		3	12	8	
Foreign Birds			2		
Totals	117	9	337	29	
Percent of Returns		2.6	9.7	1.8	
Adjusted Population		47	21	138	64
Adjusted Percent of Returns		6.4	57.2	5.8	

Table II

Purple Finches reported in Christmas Counts

State	No. of Counts	53/4	54/5	55/6	56/7	57/8	58/9	59/60	60/1	Percent of total 56/7	57/8	58/9	59/60	60/1
N. S.	3				1	2	0	0	0					
Que.	4				75	20	3	0	12					
Me.	2				0	4	2	6	4					
N. H.	2				4	4	10	22	14					
Vt.	3				3	3	29	0	12					
Subtotal					83	33	44	28	42)					
Mass.	13				80	131	574	235	288)					
R. I.	2				15	12	105	62	33)					
Conn.	8				121	194	693	352	318)	— 67	40	76	51	71
N. Y.	30				54	81	475	247	400)					
N. J.	18				64	235	429	467	413)					
Pa.	20				11	54	139	306	281)					
Del.	2				0	1	14	78	4)					
Subtotal					345	708	2429	1747	1737)					
Md.	9	[175]	228	395	4	191	149	419	176)					
Va.	15	[138]	[219]	[244]	27	301	300	751	359)	— 17	58	21	47	28
N. C.	6	[72]	168	[302]	44	194	174	297	108)					
S. C.	3	6	9	101	0	32	25	12	0)					
Ga.	6	[130]	[104]	[91]	15	297	30	145	37)					
Subtotal		[521]	[728]	[1133]	90	1015	678	1624	680					
Fla.	13	[6]	[8]	[63]	1	13	10	16	1					
Grand Total					519	1769	3161	3415	2460					
Percent of 8-year Mean; Md. - Ga.		64	90	140	11	126	84	201	84					

Table III

Evening Grosbeaks reported in Christmas Counts

	53/4	54/5	55/6	56/7	57/8	58/9	59/60	60/1
Md.	[0]	32	44	0	56	1	130	1
Va.	[0]	[85]	[60]	0	90	0	172	4
N. C.	[0]	4	[6]	0	5	3	42	0
S. C.	0	0	0	0	0	0	0	0
Ga.	[0]	[0]	[0]	0	0	0	13	0
Total	[0]	[121]	[110]	0	151	4	357	5

A difficulty in analyzing Christmas Counts rests on the variation in the number of reporting stations from year to year. The method I chose to eliminate this difference was simply to use only the reports of those stations which had reported in all five years. This does not eliminate all the variables. For the southeastern states, Maryland to Florida, the same standard stations were used for the seasons 53/4 to 55/6 but adjustment was made when some were missing. For example, if five out of six stations reported, the total for the five stations was multiplied by 6/5 and entered in brackets. It will be seen that the variation in the recorded count for each state varies rather irregularly but that the states of the southeastern group (omitting Florida) tend toward a regular alternation of highs and lows from 1954-55 on. When the subtotals for this group and the northeastern group (Mass. to Del.) are compared as percentages of the total for all eastern states and provinces, they show distinct evidence of being out of phase for the last five years. We may conclude that a high winter population of Purple Finches in the southeastern states results in a drawdown of the wintering population in the northeast.

For a comparison we turn to Table III, which treats the Evening Grosbeak in the same manner as the Purple Finch for the southeastern states. Here the alternation is even more striking for the seasons 1955-56 to 1960-61 but the two preceding seasons are quite out of step.

It may be objected that the percentages given in Table II do not take account of the lower number of counts for the southeastern states. This is valid if one wishes to compare the two groups of states within one year. The comparison made above is really one of successive years within each group of states. One measure of density of population is available, namely the number of birds per count. This is given in Table IV. It will be seen that we have again a regular alternation of densities in the southeastern states but not in the northeastern group. At the same time the density of the high population years in the southeast is always at least a little greater than that in the northeast in the same year and vice versa.

Certain statistics on arrivals and stays of the 430 birds which had appeared by the end of March in some years are displayed in Table V. In this table and in Table VI the term "day group" is used. It means a span of days designated by its lower limit and having its upper limit one day less than the lower limit of the following group. For example, "30" means

Table IV

Purple Finches per count

	56/7	57/8	58/9	59/60	60/1
Mass.-Del.	4	8	26	19	19
Md.-Ga.	2	26	17	42	17

Table V

Statistics of arrivals and stays

Month of arrival	No. of arrivals	% of total arrivals	Likely maximum stay. days	No. of stays of 30 or more days	% of month's arrivals	Mean stay, day groups	% of likely maximum	Range of stays, day groups
Nov.	6	1.4	150	4	67	110+	74+	110+
Dec.	50	11.6	140	20	40	90	66	50-110+
Jan.	46	10.7	110	26	56	60	55	30-90
Feb.	98	22.8	80	44	44	50	62	30-70
Mar.	230	53.5	50	1	½	40	80	40

Table VI

Length of stays of birds showing returns

Length of day group	No.	Length of day group	No.
<10	14	60	6
10	2	70	
20	3	80	1
30	2	90	
40	1	100	2
50	7	110+	6

Mean = 40

Table VII

Arrivals and departures of birds showing returns

		Arrivals	Departures
Nov.	2	1	
	3	4	1
	1	3	1
Dec.	2	1	
	3	7	1
	1		
Jan.	2	3	
	3	5	
	1	9	3
Feb.	2	2	6
	3		2
	1	2	4
Mar.	2	2	4
	3	3	4
	1	2	14
Apr	2		4

a length of stay of 30 to 39 days. Quite evidently the lowest group will be shown with the symbol $<$ which means "less than" and one with a $+$ has no defined upper limit. In column 4 of Table V the word "likely" is used because we cannot now and may never be able to state the possible maximum.

It will be seen that I have, in Table V, only taken account of stays of 30 days or over. This choice is arbitrary. It includes 57 percent (See Table VI) of the stays registered by the individuals showing returns. The intention is to make an approximate separation of winter residents from migrants and to examine the stays of the former. If we were to take day group 50 as the minimum, the mean stays as here expressed would not be altered but the percent of the month's arrivals would be somewhat reduced in January and February. Of course, March would lose its one "long stay" bird.

Taking matters as they stand in Table V, we find as I did in a previous investigation (Blake, 1957, p. 35) that a disproportionate share of the long stays are produced by a particular class of birds. In the present case these birds are those that have shown returns. Twenty-one birds have shown a total of 44 appearances with the lengths of stay set forth in Table VI. Of these appearances 25 resulted in ascertained long stays. Actually, all of these long stays were derived from 16 birds, which put in 32 appearances before April 1. Taking percentages we find that 3.4 percent of the birds handled produced 7.4 percent of the appearances recorded in Table VI and these, in turn, produced 26.3 percent of the stays of 30 days or over. It should also be pointed out that all of the long stays recorded for the November arrivals are derived from those same 16 birds.

From Table V we see that a considerable majority of the November arrivals are winter residents. The main southward transmigration seems to occur in December and the northward one begins in March. It will be seen presently that the latter migration may extend into April.

For Table VII the months are each divided into three periods designated by superscript numbers as follows: $^{(1)}$days 1 to 10, $^{(2)}$days 11 to 20, $^{(3)}$days 21 to the end of the month. The variation in the length of the last period is not often of significance compared with the variation in the number of items registered in a period.

It is evident from Fig. 1 that most birds have departed by April 10, but that the peak population occurs in three out of four years in the last third of March. It may be concluded that there is a relatively large spring migration culminating at the end of March in the years when a considerable number of birds winter to the south of this station. On the other hand it is not yet clear why there is a gradual build up during January and February of the numbers present. Table V shows that proportion of arrivals is essentially the same in December and January but doubled in February.

Table VII considers another aspect of the behavior of the same birds used in Table VI. Even if they are not all attached to a definite wintering ground in the years when they move into the southeast, they at least show a moderately consistent pattern of occurrence. The bulk of the arrivals have taken place by February 10 and the bulk of apparent departures occur after that date. This suggests that spring migration begins about the middle of February with the departure of some local winterers and may antedate the arrival of migrants from further south.

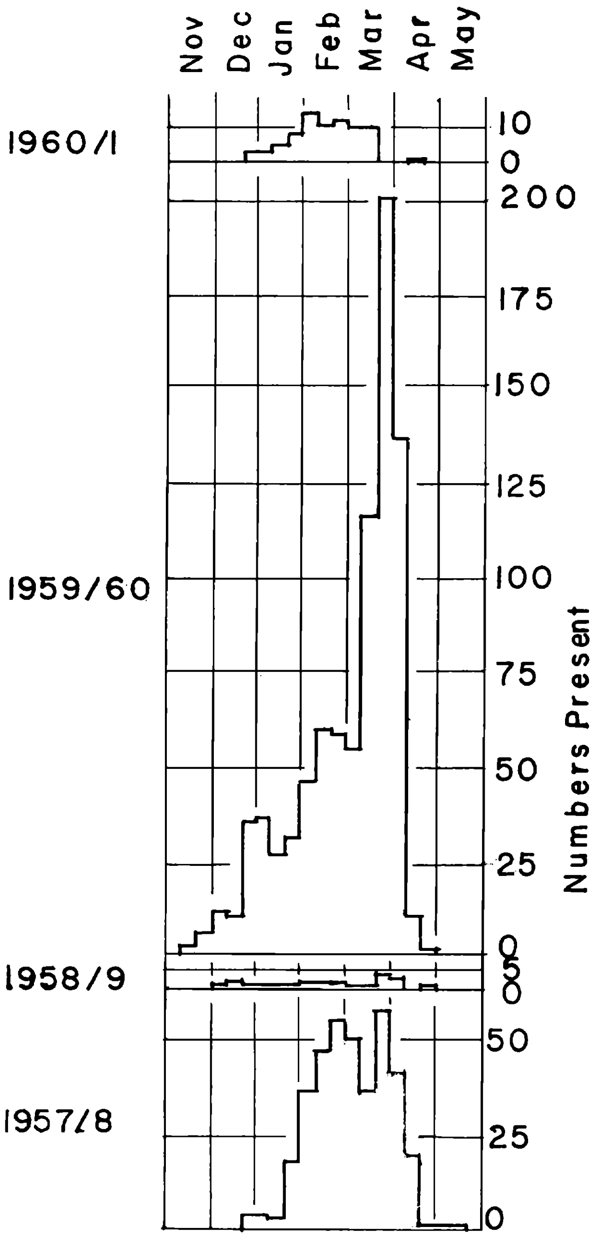

Fig. 1. Numbers of banded Purple Finches present at Hillsboro, N.C. during each third of a month in the months and years stated.

The ordinary effects of mortality demand that more birds go south in the fall than north in the spring. My data (see especially Fig. 1) show clearly that the spring migration must involve many more birds than the fall migration. There is evidence that, at Hillsboro, the Purple Finch is not unique in this respect. We must seek some explanation more general than the idiosyncrasy of one species. The first point to be made follows from the simple arithmetic of the situation: the fall route is different from the spring route. The map (Fig. 2) affords a suggestion as to the mechanics of this shift. We suppose, first, that the main migration pathways roughly parallel the coast. I interpret the data so far published on Operation Recovery as showing that the coastal build up during fall migration, although doubtless real, accounts for only a small fraction of the birds breeding in eastern New York, New England, and the Maritime Provinces. If the migration were not proceeding on a broad front trending considerably west of south but rather due south to the coast and then in a narrow band along the coast, we should have evidence from Island Beach, N. J., and, *a fortiori,* from Cape May of the passage of several hundreds of thousands or, more likely, some millions of birds. Regardless of our guesses as to numbers, if the birds that went down the New Jersey coast were either to cross Delaware Bay or to go around it and, in either event, south along the Delmarva Peninsula we should expect numbers at Ocean City, Md., or Chincoteague, Va., to be about the same as those at Island Beach or Cape May. Turning to the report on Operation Recovery for 1958 (Baird *et al.,* 1959-147)

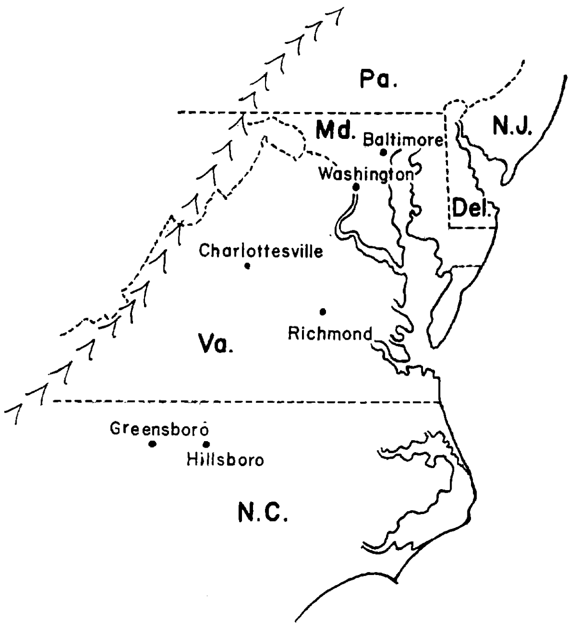

Fig. 2. Sketch map of part of the middle Atlantic states. The line of chevrons at the left shows the approximate ridge of the Appalachians.

and expressing the results for the four above named stations as net hours per bird, we find:

Island Beach	2.9
Cape May	3.2
Ocean City	6.5
Chincoteague	10.0

It is unlikely that birds passing down the New Jersey coast are continuing nearly south to the coast of the Delmarva Peninsula. I submit as a tentative route that these birds together with others using more inland paths are deflected westward around the heads of both Delaware and Chesapeake Bays and go southwestward across Virginia and North Carolina. This course would put the main concentration west of Hillsboro. As a corollary the fall migration of northern breeders over the coastal plain of North Carolina must consist mainly of eastward moving vagrants. My own observations on the North Carolina coast suggest that birds moving south through tidewater Virginia are deflected west by Albemarle and Pamlico Sounds. It is evident that coastal migration is poor as far south as Wilmington, N.C.

In contradistinction to the above argument it is worth noting that the Chipping, Field, and Song Sparrows which breed at least as far south as central Virginia exhibit a fall migration which produces more birds than the spring migration. For these species there is nothing to throw a nearly complete "migration shadow" over the Hillsboro area.

SUMMARY

The differences between seasons in the total number of Purple Finches present at Hillsboro, and in the southeastern states generally, arises mainly from changes in the wintering area of the same individuals rather than from differences in total population size.

The earliest arrivals are predominantly winter residents, and returning birds account for a disproportionately large share of the long stays.

The very limited fall migration seems to occur in December and the much larger spring migration in March and early April. Winter residents begin to move out by the middle of February.

So far as birds breeding entirely north of Maryland are concerned, Delaware and Chesapeake Bays cast a migration shadow in the fall over eastern North Carolina as far west as Hillsboro.

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