WACHUSETT MOUNTAIN:

EIGHT YEARS AND 100,000+ BROAD-WINGS LATER

by Leif J. Robinson

Dedicated to Tom Lipsky, who someday may be fortunate enough to have a teacher's strike linger into mid-September.

A flight of 10,000 Broad-winged Hawks over Wachusett Mountain in Princeton, Massachusetts, on September 13, 1978, was unprecedented for any New England site. The spectacle so stunned the four who witnessed it that they soul-searched for months to assure themselves that they really saw what they thought they saw. Since then, the 1978 flight has paled compared to one-day totals of 20,000 in 1983 and 17,000 in 1984.

Years of consecutive-day coverage have made it clear that Wachusett Mountain can be expected to yield from 7000 to more than 25,000 Broad-wings each September. It can also toss up huge one-day displays now and again. But when? I attempt to answer that question by analyzing the Wachusett Mountain records from 1978 through 1985, as prepared and distributed by Paul Roberts of the Eastern Massachusetts Hawk Watch.

Wind direction. Everyone knows that wind direction plays a major role in producing hawk flights. Each dot in Figure 1 represents one day's count of Broad-wings, plotted circularly in the direction of the prevailing wind and radially according to the number of birds seen. It is evident that flights of 10,000 or more Broad-wings have always arrived on northerly or northeasterly winds. Smaller flights, though still numbering in the thousands, have usually taken place on northwesterly winds. Nevertheless, some exceptions are notable: 2500 birds on a southeast wind and 3000 on a west-southwest wind. The smallest flights depicted, 50 to 200 birds, occurred when the wind was predominantly in the southwest-northwest quadrant, a pattern quite unlike those of the larger flights.

Thus, it seems evident that as the direction of the wind shifts counter-clockwise from the northeast to the southwest, the size of the flight decreases. This trend is illustrated in Table 1, where for various levels of flight activity the percent of flights occurring within a narrow range of wind direction is given.

Table 1. Flight Sizes and Prevailing Wind Direction

FLIGHT SIZE	WIND DIRECTION	% OF FLIGHTS
>10,000	N -- NE	100
1000-10,000	NW -- NE	77
200-1000	NW -- NE	72
50-200	SW -- NW	89

When the birds pass. The question is how to assess these flights year after year, especially when the observers change and when substantial numbers of birds might have been missed due to lack of coverage. Cumulative percent seems like a good solution. Cumulative percent is derived as follows. First divide the number of birds seen on any given day by the total number of birds seen during the count period. This gives the percent for that day. Then, from the day on which birds are first seen, each successive day's percent is added to those of all preceding dates to get the cumulative percent. This accumulation is continued through the last on which birds were seen. At that point the percent equals 100, for all birds have been included. Figure 2 shows the average cumulative percent of Broad-wings that passed Wachusett Mountain during the period from 1978-1985. The steep rise in the curve between September 10 and 16 indicates that the vast bulk of the Broad-wings goes past Wachusett Mountain in less than a week. (To give cumulative percent in a more familiar context, on the right side of Figure 2 are the corresponding cumulative numbers of birds, based on an assumed annual flight of 13,500.)

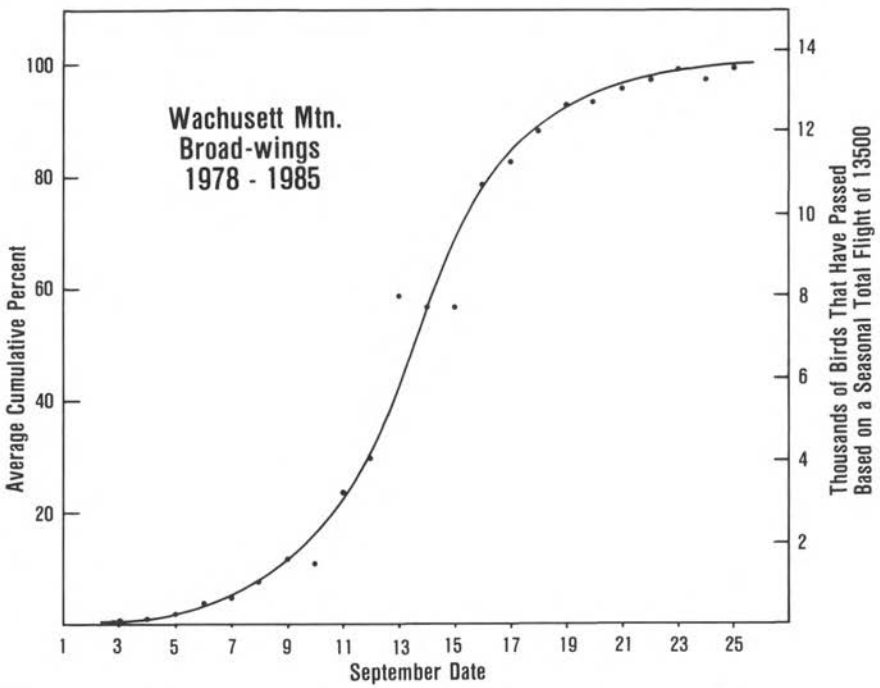

Figure 2. This curve shows the average rate at which Broad-wings pass Wachusett Mountain during autumn over the years studied. The steeper the curve, the more birds pass. The legend at the right is based on an assumed annual total of 13,500 birds.

Wachusett Mountain flights seem to divide into two kinds. Spectacular "explosive" flights, with essentially all the birds passing through in one day, occurred in 1978, 1983, and 1984. More usual are "protracted" flights, extending over one or two weeks. The following equations represent both kinds of flights. C% is the cumulative percent, expressed as an integer, reached on a particular September day (D).

Average for explosive migration: C% = 27.1 x (D minus 11.5)

(Use between September 12 and 15, non-leap-year dates)

Average for protracted migration: C% = 6.66 x (D minus 6.86)

(Use between September 7 and 21, non-leap-year dates)

These formulae can be used to predict when an explosive-type migration might occur. Typically, about 20,000 Broad-wings pass Wachusett Mountain in such a year and 10,000 in a protracted year. An explosive migration, therefore, is likely if the cumulative count of birds follows the pattern below.

September 9 less than 1400 Broad-wings
September 10 less than 2100 "
September 11 less than 2800 "
September 12 less than 3400 "

Birds per hour (BPH). Averaged over the years 1978-85, the Wachusett Mountain Broad-wing peak occurs on September 13 -- averaging about 260 BPH. Also from averages over those eight years, Table 2 gives the range of dates during which particular BPH rates can be expected to be exceeded.

Table 2. BPH rates in September

BPH greater than 50	September	9	to	19
BPH greater than 100	"	11	to	17
BPH greater than 150	"	11	to	16
BPH greater than 200	"	11	to	15

Conclusions.

1. In any year there should be two days between September 9 and 19 yielding 2000 or more Broad-winged Hawks.

2. For an explosive flight day of 10,000 or more birds, the wind should be from the north or northeast; a more westerly component can still produce flights of several thousand birds. Such flights take place between September 12 and 16 (non-leap-year dates). Circumstances are particularly attractive when 2800 or fewer Broad-wings have been logged through September 11.

3. Wachusett Mountain has proved itself to be a very predictable site for autumn Broad-wing watching. The data are so consistent that at least one superb flight day can be virtually guaranteed annually to anyone who sits atop that hill for a few days in mid-September.

4. Despite extensive observations over eight years, the Wachusett Mountain flights still pose many questions. One of the most intriguing concerns the interpretation of annual variations in the intensity of migration. Are explosive flight years really different from years with protracted activity, or are both thrusts merely parts of one process?

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