REVERSE NOCTURNAL MIGRATION

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In order to explain reverse flight it becomes necessary to review briefly some of the more recent concepts of nocturnal migration. Most workers today believe that there is a relationship between the periodic movements of birds and the weather (see Bagg, 1948, 1950, 1955, 1956; Lowery, 1951; and Raynor, 1956).

According to Devlin (1953, 1954) wind is the most important climatic element to be considered, *i. e.*, night migrants make southbound flights on north winds and return on south winds. Raynor *(loc. cit.)* is convinced that south winds are correlated with spring nocturnal land bird migration, but he believes that atmospheric stability is more important than wind direction. It should be noted here that tropical air masses (south winds) are always stable at night in spring.

Williams (1950), Raynor, Devlin, and others agree that migrants fly all night. Once in the sky, they do not land before daybreak regardless of changing weather conditions. Apparently, migration is initiated at dusk (the *critical* time) only when the wind is blowing in the general direction of flight.

FALL WEATHER AND FLIGHT PATTERNS

The northwest to southeast movement of birds is a well-recognized feature of fall migration in North America, and it seems not to be a mere coincidence that most of the great polar air masses move in the same direction during that time of year. The arrival of a cold front brings lower temperatures, and it has been generally thought that a sharp drop in temperature may be needed to stimulate migration. We believe that a temperature fall is not necessary. Low temperatures have a limiting effect, and virtually no departure takes place below 60° F. (Devlin and Wykoff, in press).

CONDITIONS WHICH PRODUCE REVERSE MIGRATION

When a rapidly traveling polar air mass moves in a southeasterly direction off the New Jersey shore and meets the warm air currents of the Gulf Stream, it tends to slow down or become stationary. Migrants following such winds in the night get out to sea and become concentrated in the area at the

front where the cold air underruns the tropical air. Polar air masses are nearly always unstable; as they move they absorb heat and moisture. Rain and fog are typical of a cold front passage, and the upward rush of warm air, especially at sea, often results in violent thunderstorms making an effective barrier to migration. Slow-moving, offshore cold or stationary fronts are nearly always in such a position that northwest winds swerve toward shore upon reaching the frontal area and become southeasterly. Migrants continue to follow such winds, and upon reaching shore are in reverse migration.

During any fall night at Cape May when the winds are southeasterly, and the chips of passing birds are abundantly heard, there is every reason to believe that the weather conditions described above prevail at sea.

DISCUSSION

As it becomes increasingly evident that night migrants fly with the winds new ornithological problems arise. It now becomes difficult to explain migration on a physical basis. If birds possess the ability to perceive terrestrial and coriolis forces as Yeagley (1947) believes they do, surely they can not make use of such abilities when flying with the winds at night. According to Savil's (1949) definition, we should not use the term "navigation" in reference to night flight. Last miles of migration may be accomplished in the daytime by topographic memory and random flight (Griffin, 1952). Perhaps navigational mechanisms are used only in the daytime.

At night, migration takes place with the winds in a general southerly direction, and birds do not make exactly the same journey each fall. It seems that when reverse patterns persist along the coast, fewer transients are seen in the middle Delaware Valley, and conversely when such conditions are infrequent, we have a "good" migration in the valley.

Occasionally, the results of a "strong" reverse migration are witnessed well into the interior as far north as Philadelphia.

SUMMARY

The authors have been engaged in a study of passerine nocturnal migration since 1950, and all of the data gathered from seven northward and seven southward flights point to that fact that migrants follow the winds in the general direction usual at the time of year. Departure takes place at dusk – *the critical time.* Birds do not leave in the night, nor do they land at night; once on the wing, they continue to fly even though shifting winds may carry them into reverse migration. Such conditions have been observed frequently at Cape May, New Jersey. A collection of reverse nocturnal weather patterns, reproduced with this paper, will illustrate the conditions under which waves of migrants may be expected during the fall.

ACKNOWLEDGMENTS

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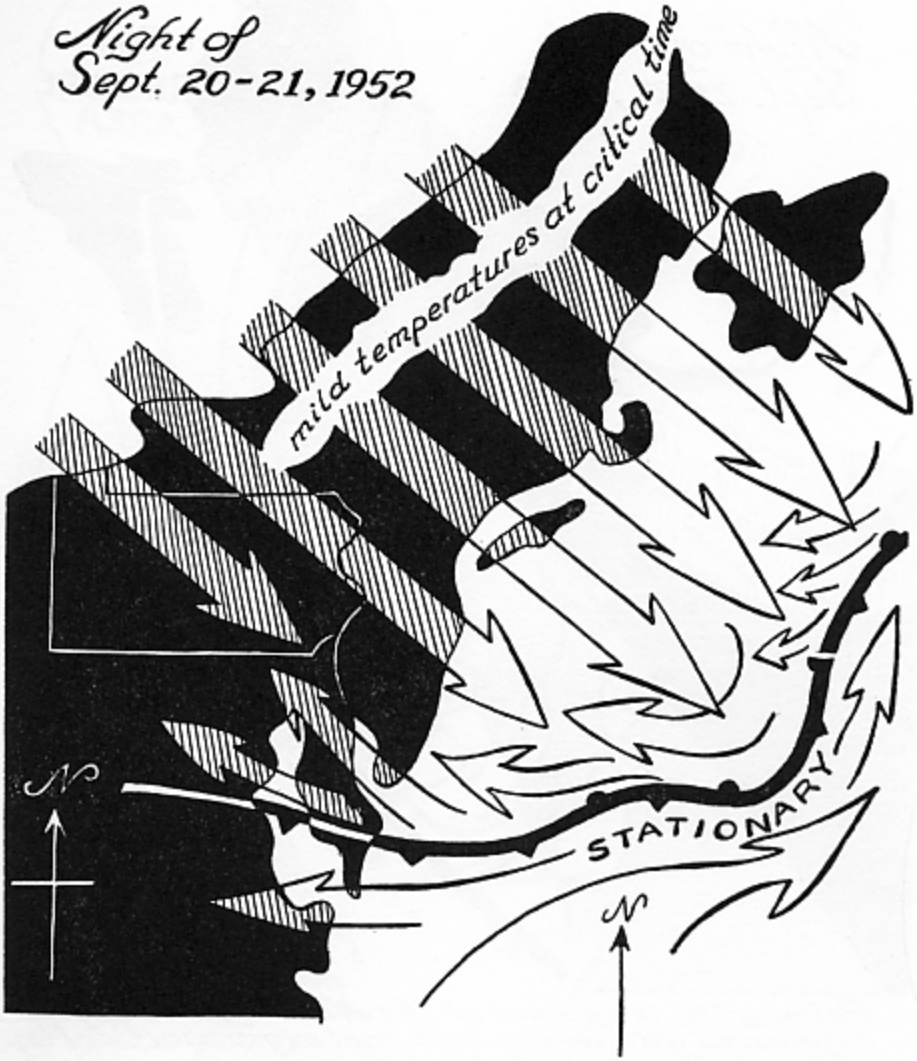
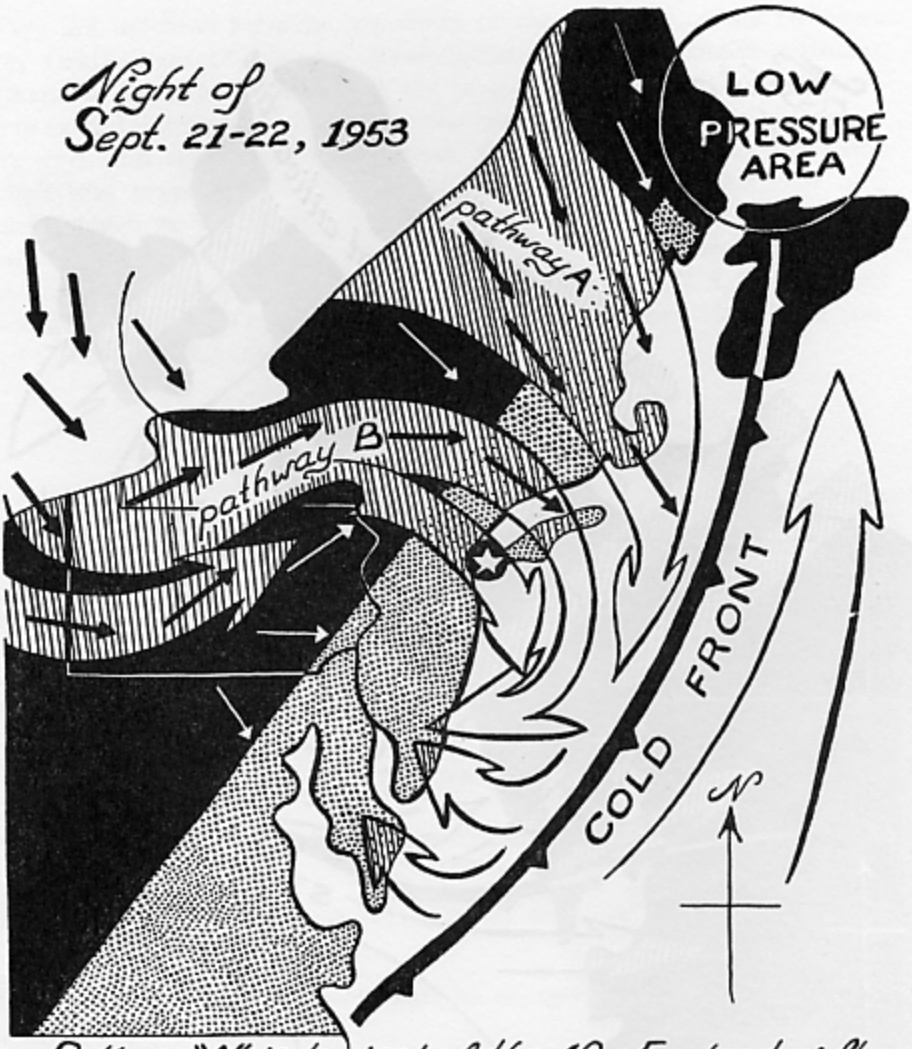
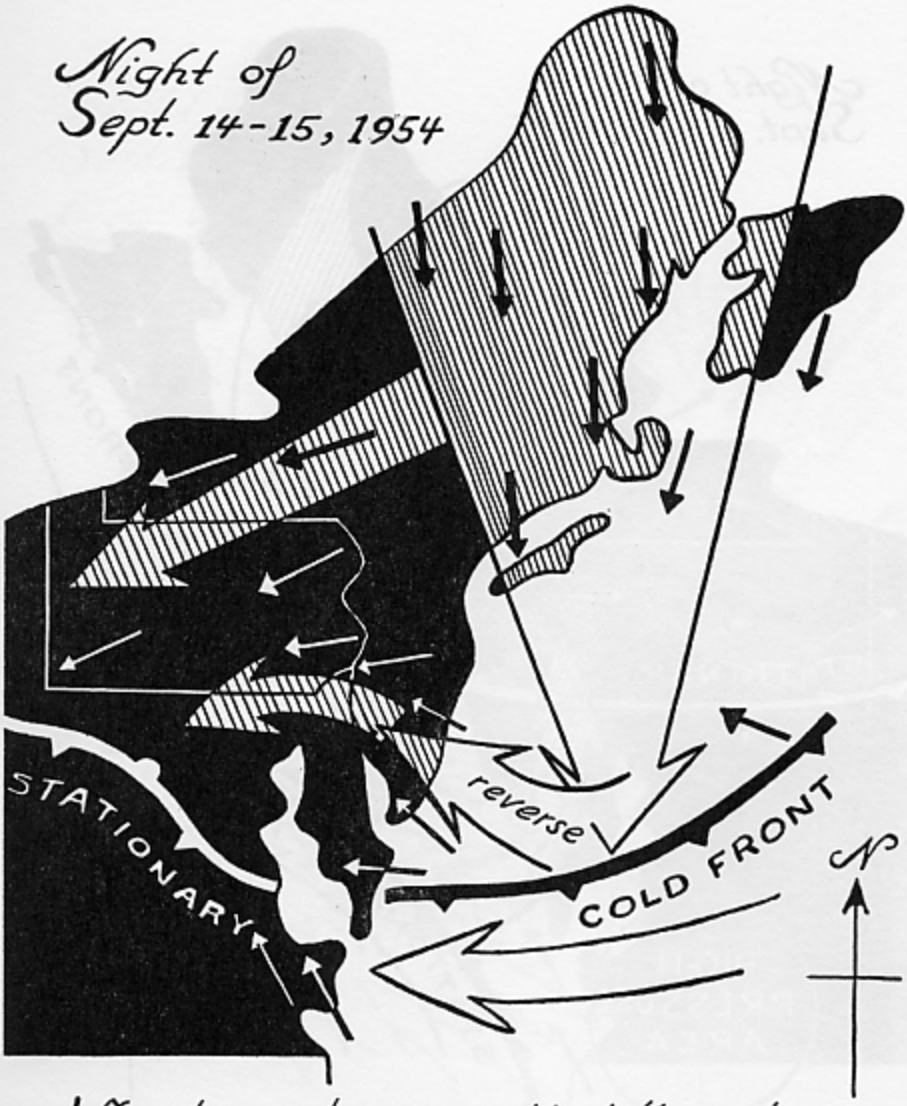


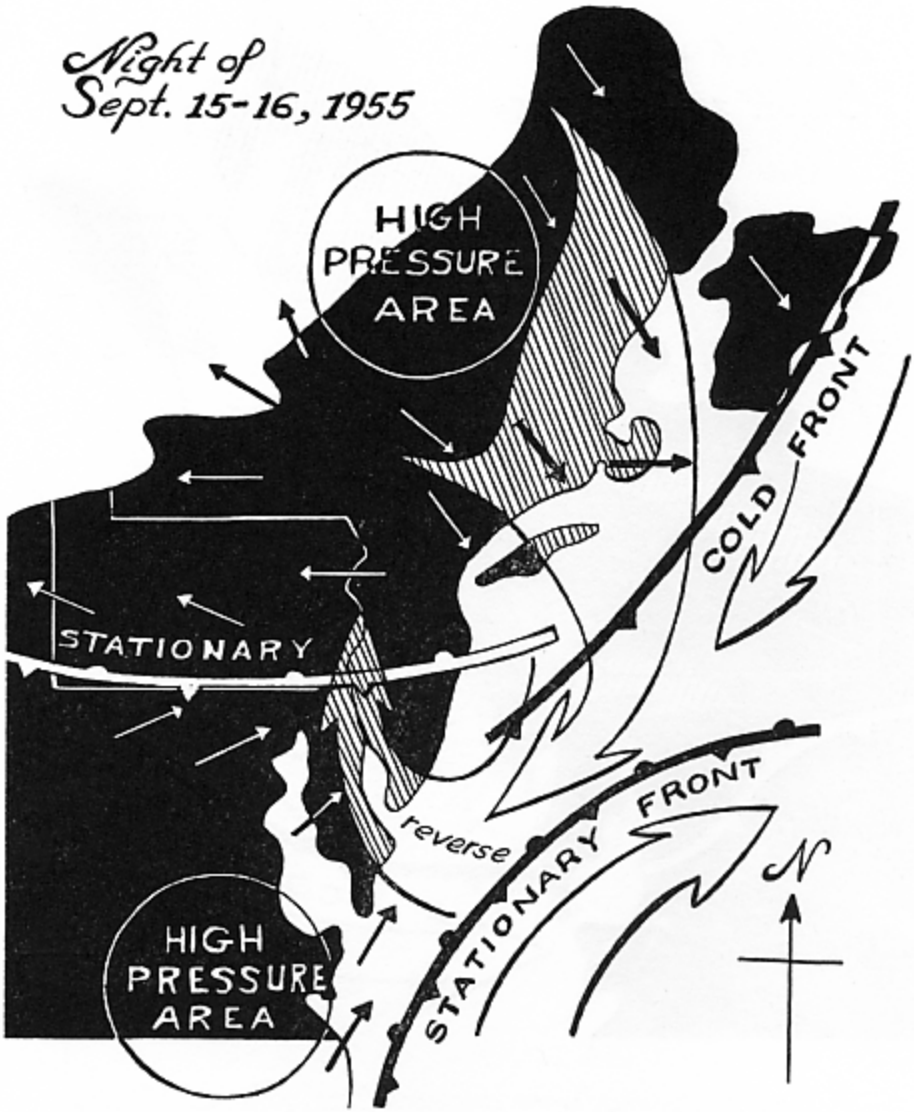
One of the greatest (perhaps the greatest) migratory flights on record occurred at Cape May on this weather pattern.



Pathway "A" is typical of the New England airflow associated with reverse nocturnal migration at Cape May. Apparently, reverse migration also occurred along pathway "B," for many mid-western species were noted by observers throughout that area. The stippled area designates a low ceiling region (cold front slope). More than 300 birds (flying low under slope) crashed into the Empire State Building in New York City ✪. Most of these were Tennessee warblers.



When temperatures are mild at the critical time, this type of wind pattern always produces migrants in season at Cape May. When such conditions continue after daybreak, diurnal migrants (flickers, waxwings, bobolinks, etc.) follow the same pathways and can be seen coming in from the sea (often in large flocks) on east or southeast winds at the Cape.



This weather pattern produced a large wave of nocturnal migrants at Cape May and throughout the Delaware Valley. At Philadelphia the largest thrush-warbler wave of the season occurred.

The effects of a great migration were noted far up the Delaware Valley into the Philadelphia region. A number of nocturnal migrants met with death in the turbulence about tall city buildings.