

The diurnal migration of passerines along an Appalachian ridge

The Allegheny Front Migration Observatory monitors the autumn migration

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IT IS WELL KNOWN that the ridges of the central Appalachians form flight paths for the southbound migration of raptors; each autumn hundreds of birders gather at a number of favored lookouts to monitor the flight or simply to enjoy this spectacle. It is not so widely appreciated that these ridges also serve as flight paths for many species of passerines, particularly warblers. The magnitude of the passerine flight along the Appalachian ridges became apparent to us in the mid-1950s at about the time that others were starting intense fall banding operations at points on the Atlantic Coast under the project known as *Operation Recovery*. Our obvious response was to open a banding station at a suitable location in the Appalachian Mountains. In 1958 the station now known as the Allegheny Front Migration Observatory was begun and it has continued in operation each fall since. The initial years had only a rather modest coverage, and banded comparatively few birds, but once the best netting sites were discovered and coverage and manpower increased large numbers of birds were handled. In the 21 years between 1958 and 1978, 56,720 birds of 108 species were captured and banded. (Since this paper was written two more seasons have occurred and the totals are now 66,871 birds of 109 species).

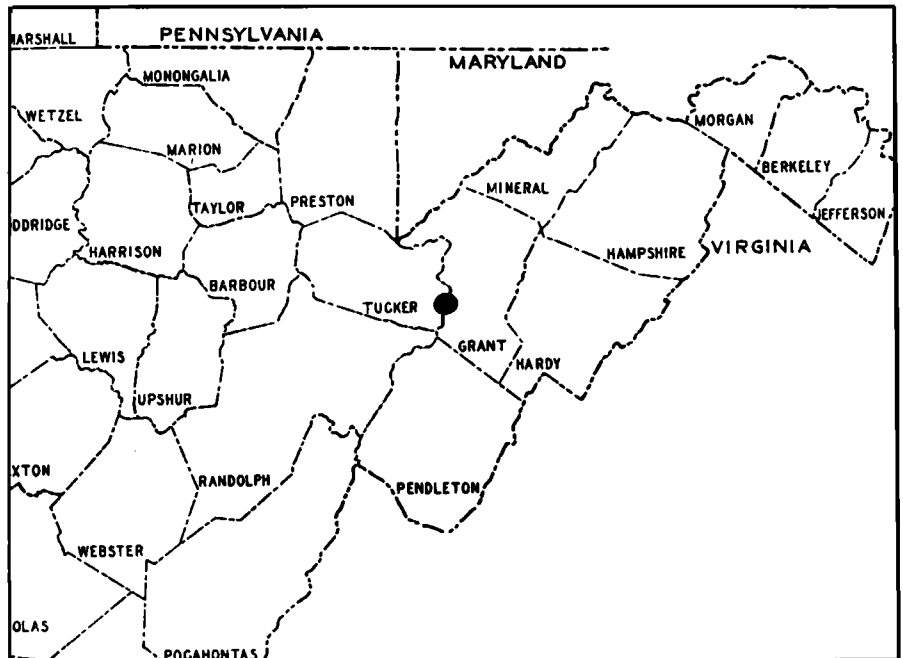
The observatory is located on the mountain known as the Allegheny Front, which here forms the border between Grant and Tucker Counties, West Virginia. This mountain is a long ridge that originates in central Pennsylvania and extends from northeast to southwest into West Virginia. The mountain has a steep escarpment on its eastern face but slopes off more gradually to the west. Locally this escarpment (front) forms

the boundary between the drainage to the Atlantic Ocean via the Potomac River and that to the Gulf of Mexico via the Ohio and Mississippi Rivers. The highest elevation of the ridge is reached near the banding station where the escarpment rises steeply from a valley at an elevation of about 550 m (1800 ft) to a height of just under 1200 m (3950 ft).

The general floristic and faunal aspect of the summit plateau near the banding station is similar to that of boreal central Canada. Groves of scrubby red spruce alternate with fields of blueberries and heaths, boulder fields, and occasional sphagnum bogs. The most characteristic nesting birds are Gray Catbirds, Chestnut-sided Warblers, and Dark-eyed Juncos, but the spruce groves have Hermit Thrushes and several boreal warblers. This mountain top is familiar to a

myriad of hikers and other outdoorsmen as the Dolly Sods Wilderness Area of the Monongahela National Forest, but is not so well known among the bird-watching fraternity.

In mid-day during September thousands of Broad-winged Hawks will sometimes be seen following this ridge, but in the early morning it is the flight of small birds that attracts the birder's interest. This flight usually begins about an hour after sunrise, but will occur only on days when the wind blows from the northwest quadrant. The small passerines, mostly warblers, follow the eastern side of the ridge, toward the southwest, while flying out over the valley at an elevation just below that of the ridge. They are thus out of the general force of the usually strong northwest winds. Indeed the turbulence created as the wind



Map showing location of Allegheny Front Migration Observatory.



View eastward from the station. (A. Hall).

comes over the edge of the escarpment may supply additional uplift for them and make their task somewhat easier. At the Observatory site the local topography would force the birds to shift direction to the east if they were to continue to follow the ridge. Apparently they are unwilling to do this, because they continue in about the same southwesterly direction which causes them to fly up a ravine and cross the mountain through a broad pass, the only interruption in the mountain ridge for several miles. The banding station is located at the edge of the escarpment at the head of the pass. Just below the station (to the east) the ravine broadens into a basin. Many of the birds will rest briefly in the low trees of the basin before passing on up over the top. Crossing the mountain requires that they fly against the wind and so they normally fly quite low, barely clearing the ridge top. After going through the gap, the birds continue to fly in a more or less southwesterly direction along the valleys cut by the streams of the western drainage.

ON A GOOD FLIGHT DAY an observer perched on a rock at the summit of this pass can witness one of the great spectacles of bird migration to be found in eastern United States. As dawn begins on a September morning the sound of thrush call-notes fills the air. These are mostly from Swainson's Thrushes landing after their night's flight. A few Ovenbirds and a sparrow or two will be part of this flight. Later in the season large numbers of White-throated Sparrows and fewer thrushes will be present.

This nocturnal flight will subside before the sun rises over the next ridge to the east, and then there will be a lull during which little activity occurs and few birds are caught. The lull lasts for about 45-60 minutes and usually ends very abruptly. The beginning of the heavy morning flight is almost as predictable as if it had been programmed by a time clock. Suddenly the basin below the station is filled with throngs of warblers. Their "chip" notes fill the air as they come up the ravine in small groups. Some may mill around the basin for a while or they may perch briefly; eventually they fly against the strong winds and skim over the top. This passage of birds is not continuous but rather it comes in spurts. A great

many are caught in the 10-11 mist nets located at the rim; the majority pass overhead. By ten o'clock the heavy flights have ceased and by noon the flight is over. A few birds continue to fly through in the afternoon but totals captured will be small. Late in the day the warming of the rocks on the mountain-side produces an upslope draft which stops the flight of birds even as does an east wind.

The intensity of the flights at this station can be illustrated by the events of three different days. On the day of the greatest number of bandings 660 birds were handled. On a day of probably even greater bird activity 550 birds were caught before 8:30 a.m., when the nets were furled because the banders present could not keep up with the heavy traffic and all storage facilities were full of birds. Finally, on a day that may also have been one of the very heaviest, 400 birds were caught by a lone bander using only two nets. One net caught 60 birds at one time, 20 more flew into it while the first birds were being removed. These were exceptional, and memorable, days but catches of 150-300 birds are registered on many occasions each autumn.

Often there will be two or three days of good flights, followed by a lull of several days (when captures will be below 100) and then another wave of migrants will come. This succession of waves continues from late August to early October with the heaviest flights usually occurring in the last half of



Net lanes and station sign

September. Sometimes, however, clouds and fog may blanket the mountain top for two to three days and no birds pass through during these periods. Indeed, at this elevation the last of September often sees freezing weather, and occasional snow. By mid-October the mountain has assumed its winter aspect, and while flights of some birds continue, the banding in station was usually closed for the season.

DESPITE THE LARGE number of birds banded there have been rather few recoveries of these birds elsewhere. A few Blue Jays have been found in Alabama and New York. A Blackpoll Warbler was recovered in the Dominican Republic during the fall of banding, and another was recovered in Montana the spring after banding. A Bay-breasted Warbler was found on an oil rig off the Texas Gulf Coast the spring after banding. A Tennessee Warbler was netted at Powdermill Nature Reserve near Rector, Pa., in the spring following its banding. We have also caught four birds banded elsewhere: a Sharp-shinned Hawk banded at Point Pelee, Ontario; a Cape May Warbler banded at Long Point, Ontario, ten days earlier; a Tennessee Warbler banded north of Sault Ste Marie, Ontario, recovered two years after banding and a Wilson's Warbler banded at Charleston, West Virginia, recovered a year after banding. This last recovery gives some insight into the birds' fidelity (or lack thereof) to a given route during the migration; Charleston is some 125 airline miles west of the Observatory.



Extracting a bird from a net, (A. Wylie).

The birds handled at Allegheny Front nest in the wilderness of the North Country, winter in the wilderness of the tropics, and are banded at a wilderness station. Thus the lack of recoveries is not surprising.



View of spruce woods, and the net lanes. Nets not visible.

THE SPECIES INVOLVED

OF THE 56,700 BIRDS that have been banded, 56,400 (99 + %) have been passerines and about 40,000 of these have been warblers. This is both a result of the species composition of the birds passing through the area, and our use of fine-mesh mist nets that cannot hold most large birds, even if they fly into them. The banding totals station in October, before the fall migration has ended.

Non-passerines—Although many raptors use this mountain as a flyway, only 11 Sharp-shinned Hawks and one Cooper's Hawk have been banded. In late September and early October Sharp-shinned Hawks are often seen patrolling the net lanes, and they occasionally perch on the net poles. Other non-passerines include Saw-whet Owl, both cuckoo species, and six species of woodpecker. Although only one has been banded, small groups of up to 6-8 Red-headed Woodpeckers are frequently seen flying along the ridge. Many Ruby-throated Hummingbirds cross over the mountain, usually in mid-day or afternoon, but few have been banded.

Flycatchers through Wrens—Flycatchers do not constitute an important part of the flight past this station, with a total of only 247 birds of seven species banded. Least Flycatchers (69), Eastern Wood Pewees (68), and Yellow-bellied Flycatchers (57) lead the list. No swallows have been banded, but in

August large numbers of several species have been seen flying across the mountain; they use the same route as the warblers but fly higher. Blue Jays constitute one of the important components of the flight. These birds come in mid-day, often in large numbers, but rather few have been banded (1243) compared with the numbers that pass over. Such normally sedentary species as White-breasted Nuthatches (39) come in small numbers. The occasionally eruptive Black-capped Chickadee is caught more often (314) and the supposedly non-migratory Tufted Titmouse, which does not nest at this elevation, has been banded 96 times over the years. Red-breasted Nuthatches are exceedingly common in some years, and Brown Creepers move in some numbers. Four species of wrens have been banded but only the Winter Wren, with 119 bandings, is other than casual.

Mimids through Vireos—Gray Catbirds and Brown Thrashers nest at the station site but only 429 of them have been banded. Thrushes constitute a major portion of the flight with 363 robins, 380 Wood Thrushes, 167 Hermit Thrushes, 4593 Swainson's Thrushes, 250 Gray-cheeked Thrushes, and 118 Veerys banded. The Hermit Thrush total might be higher if the Station were operated later in the season. Both species of kinglet are common in early October and, oddly, 793 of each have been banded. A few Blue-gray Gnatcatchers are seen along the ridge. Cedar Waxwings are an important migrant through this pass, although they normal-

ly fly so high that only 108 have been banded. On one day a few years ago it was estimated that several thousand waxwings passed over the station. As they came up the ravine many would stop to rest in a tall spruce tree. With several hundred birds in the tree at one time it looked like an early Christmas tree. Five species of vireos have been caught. The White-eyed and Yellow-throated are rare, Red-eyed Vireos are quite common, and of greatest interest to most birders are the 268 Philadelphia Vireos banded, a species often not reported by binocular birders.

Wood Warblers—Approximately 71% of the birds captured are warblers. The species involved and numbers are given in Table 1. Indeed, five species make up 70% of the captures. These are all "boreal" warblers, although two of them, Black-throated Blue and Black-throated Green, nest in the vicinity of the Observatory. Especially numerous are Tennessee, Cape May, and to a lesser extent Bay-breasted Warbler, well known as "spruce budworm specialists." These three species have shown remarkable increases in numbers in the last 5-7 years, no doubt reflecting the severity of the spruce budworm outbreak in Canada. Golden-winged, Prairie, and Mourning Warblers nest in the station area, but these species apparently leave very early, and since the operations at the observatory start in late August, they have already departed. As is to be expected, those species whose centers of breeding distribution are to the south of the station such as Worm-eating, Hooded and Kentucky, are caught in very low numbers, and Louisiana Waterthrush has never been caught here.

Warblers are generally considered to be nocturnal migrants, and indeed they are. On many nights when the wind is from the right direction large flights of warblers can be heard passing over this mountain top throughout the night. Why then do such large numbers fly along this ridge in the daytime? Relatively few warblers are caught in the early morning when the nocturnally migrating thrushes are captured, and indeed few, if any, warblers are seen flying at this time. These observations suggest that the birds come to rest sometime during the hours of darkness and then resume their flight well after sunrise. This type of flight has been reported elsewhere (Gauthreaux, 1978) and has been interpreted as an at-

Table 1. Numbers of warblers banded at Allegheny Front Migration Observatory, 1958-1980

<i>Species</i>	<i>Total</i>	<i>Maximum Annual Total</i>
Black-and-white	265	36
Worm-eating	37	10
Golden-winged	13	3
Blue-winged	7	3
Tennessee	8305	1302
Orange-crowned	12	2
Nashville	644	131
N. Parula	55	27
Yellow	5	1
Magnolia	2645	392
Cape May	6475	1224
Black-throated Blue	6532	769
Yellow-rumped	178	29
Black-throated Green	3533	446
Cerulean	10	4
Blackburnian	2591	359
Chestnut-sided	437	57
Bay-breasted	3453	586
Blackpoll	8462	1316
Pine	2	1
Prairie	13	2
Palm	70	12
Ovenbird	1321	243
N. Waterthrush	29	5
Kentucky	3	2
Connecticut	125	25
Mourning	9	4
Com. Yellowthroat	1436	194
Yellow-breasted Chat	3	1
Hooded	88	10
Wilson's	534	62
Canada	181	38
Am. Redstart	525	104

tempt to correct for having been wind-drifted from the desired course during the night.

Icterids and Tanagers—Only 24 individuals of 3 species of Icterids have been captured, although in late October some flights of Rusty Blackbirds, Red-winged Blackbirds, and Common Grackles have been observed at the station. Two hundred sixty-two Scarlet Tanagers have been banded.



Banders at work: L. Wilson (l) and G.A.Hall

Fringillids—Operations at the Observatory usually cease well before the heavy flights of sparrows and finches in late October, but 540 White-throated Sparrows and 1260 Slate-colored Juncos have been banded. Many of the latter are a part of the resident population. A

feature of late September is the heavy migration of Rose-breasted Grosbeaks past this point. The total of 817 captures does not adequately sample the magnitude of this flight as these birds fly fairly high and go over the nets. A notable deficient species is the Indigo Bunting, an abundant nesting bird throughout this general region, but only 19 of which have been captured. In late October and early November there are occasionally heavy flights of Evening Grosbeaks, Pine Siskins, Purple Finches, and on occasion even Lapland Longspurs and Snow Buntings, but this flight has not been sampled by banding.

LITERATURE CITED

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