

THE BREEDING WARBLERS OF THE CENTRAL ALLEGHENY MOUNTAIN REGION

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MOUNTAIN masses, and the interpretation of their plant and animal life, present a standing challenge to the biologist. The Appalachian mountain system, being of moderate elevation and located in mid-latitude regions, does not exhibit the striking contrasts to be found in high altitude mountains of more southern regions, where a climb of a few miles may take the observer from the tropical to the arctic-alpine; nevertheless our eastern ranges have been a haven of refuge for land forms since Palaeozoic times and have their fascinating problems of modern, as well as ancient, natural history.

THE AREA

The area with which this paper deals is centered roughly between the northern and southern extremities of the Appalachian system, and embraces the mountainous portion of western Maryland, all of West Virginia west of the Shenandoah valley, and portions of Frederick, Shenandoah, Rockingham, Augusta, Highland, Bath, Alleghany,¹ Craig, Giles, Bland, and Tazewell counties, Virginia. Thus it includes all of the Allegheny ridges between the Great Valley of Virginia and the Ohio River, from the Pennsylvania border on the north to the southern extremity of West Virginia. The "Ridge and Valley province" (of Fenneman, 1938) lying directly east of this territory, and the high Blue Ridge peaks of southwestern Virginia are excluded, since it is felt that their biotic conditions differ in a number of essentials from those of the area under consideration.

From the ornithological standpoint, the region is remarkably homogeneous, although the boundaries are somewhat arbitrary. Portions of southwestern Pennsylvania, the unglaciated Allegheny plateau of eastern Ohio, and parts of southwestern Virginia and eastern Kentucky might well have been included, had it not been that these areas are receiving adequate ornithological treatment at other hands.

Embracing a portion of the divide between Atlantic seaboard and Ohio-Mississippi drainage systems, the region offers a natural meeting place for forms of life which follow the mountain ridges down from the north, which gain entrance from the south through unobstructed river valleys, or which invade the area from both the

¹There is frequent confusion in literature as to the various spellings of the mountains, and some of the geographical divisions, with which this paper deals. For purposes of clarity it may be stated that the United States Geographic Board has adopted the spelling *Allegheny* for the mountains and river, *Alleghany* as the name of the county in Virginia, and *Allegany* for the county in Maryland. Usage of the names in the present paper conforms to the Board's rulings.

east and the west. At such a junction point northern and southern, and eastern and western, bird races meet, with somewhat puzzling intermediates becoming the rule rather than the exception.

THE PROBLEM

So many excellent papers on the ornithology of this territory have appeared that another one would scarcely seem justified, were it not that one factor of tremendous ecological significance has not received the attention which it deserves.

Briefly stated, this factor derives its significance from just one circumstance; within one or two generations the forests of this considerable area, relatively undisturbed for thousands or perhaps millions of years, have undergone wholesale destruction from man's lumbering operations, from the attendant fires which have swept much of the region, and from the plant diseases which have been introduced. Thus birds which had become, over long periods, habituated to a certain set of living conditions have found themselves within a comparatively short time faced with the problem of adjusting themselves to different conditions, or of disappearing from a considerable portion of their ancestral breeding range.

Because of the fact that many of these upland watersheds have now been taken over for administration as forest land by the United States Forest Service, state conservation departments, and other public agencies, we may well doubt that any such wholesale changes in the character of the country as have taken place within the last fifty years will ever occur again. Thus we are contemporaries of the birds in this transition period, and it behooves us as ornithologists to record all that we can learn of their attempts at readjustment. Fortunately, there are those still with us who can remember many of the Allegheny forest regions when they were in near-pristine condition, and we are able to draw from their memories and their records when we attempt to contrast the bird life of virgin and of cut-over areas.

To the birds, this period of rapid change, induced by man's lumbering methods, may well have been as socially significant as was the industrial revolution to human beings. Certainly we know that many species have profoundly changed their habits since the coming of the white man, as witness the Chimney Swift's readiness to adopt new breeding situations. Reference to a bird list made in the West Virginia spruce belt forty years ago, and to one made in the same region today, will show the striking ornithological changes which have occurred. Some species may have disappeared locally, and many new ones have appeared; the bird life may in fact be considerably enriched. Whatever these shifts may have been, however, practically all breeding birds of the area are now living under radically changed conditions.

There is an element of immediacy in this study. Within the region defined by this paper there are a few, but very few, scattered remnants of original deciduous and coniferous forests. Where these occur, birds may still be observed under conditions which approximate those which once obtained throughout the area. So rapidly are these virgin stands being removed, however, that a few more years may well see their practical disappearance. Unfortunately, it is not the policy of the U. S. Forest Service, at least in eastern United States, to buy and preserve original timber stands.

In areas which have undergone lumbering operations, conditions change very quickly. This is a region of rapid tree growth and heavy timber increment, and cut-over areas, even though practically denuded, are quickly clothed in vegetation which may be widely different from that which originally occupied the land. Under highly favorable lumbering methods, when fire is kept out, reforestation by the original species may occur, and here we find a minimum of disturbance to the bird life. Such happy combinations of circumstances have, unfortunately, been rare in our region. Generally speaking, vegetational changes occur in rapid succession, and he who would mark attendant changes in bird life must be on the ground, and must have ample basis for comparison and contrast.

Another contemporary change of tremendous import in the forests of the mid-Appalachian region has resulted from the introduction and spread of the chestnut bark disease (*Endothea parasitica*). On many of the Allegheny ridges American chestnut (*Castanea dentata*) was the principal timber species, and the death of the chestnuts, now unfortunately almost complete throughout the region, has left standing millions of dead trees which once helped to form a forest crown. The exposed understory vegetation is bringing about reforestation of a very different character. The dense brushy growths which have followed the death of the chestnuts have favored the nesting of a number of bird species which had previously been scarce in, or absent from, these forests. In fact, a definite association of breeding warblers in such situations may now be found throughout the area. Certain warblers (the Golden-winged is notable) seem almost to depend on standing dead chestnut trees for perches from which song is given.

This new association of species in brushy areas is one of the most interesting features of bird life in the Allegheny region today. Under the discussions of individual species it will be covered more fully. That the association is a temporary one, however, may be inferred from the fact that a few more years will see the fall of all standing dead chestnut trees, and will find the present brushy areas grown up to a new type forest.

The writer has spent practically his entire lifetime in the region which this paper includes, has camped in original stands of red spruce, hemlock, pine, and deciduous forests, and has had opportunities for

study throughout the region. In addition, full advantage has been taken of the work of others in the same field. Recognizing that no one person could possibly do justice to so large an ecological field, he nevertheless ventures to place on record some observations relating principally to the breeding wood warblers of the region, and to draw from these observations some conclusions, with the hope that they may be modified, enriched, or enlarged through the experiences of others.

THE WOOD WARBLERS

For the purposes of this study the warblers of the Family *Comptolypidae* have been selected for a number of reasons. In the first place, a large number of species breed within the area, the list including twenty-seven species, one hybrid (Brewster's Warbler), and an undetermined number of races which are known to nest, together with two or three species whose presence has been noted during the breeding season, but whose nests have not yet been found.

A second consideration is that no portion of the region is without its characteristic breeding warblers, some areas numbering twenty or more species. Another significant circumstance is that the breeding warblers are rather well distributed as to their centers of abundance. The mountain ridges harbor many species of northern association, while the region's position on the borderland of the south gives it a good representation of Carolinian forms. By far the most clearly defined biotic zone of the region is the Alleghenian portion of the Transition (as Merriam conceived it). This zone has a particularly well developed warbler population. Finally, the breeding warblers serve fairly well to delineate the biotic zones into which the territory falls.

LIFE ZONES IN THE REGION

The writer enters into a discussion of life zones with some trepidation, knowing that there are many biologists who question the validity of any or all the zone concepts so far proposed. Without going too deeply into the matter, a few general observations are ventured. The first is that, by general agreement, biotic zones are more clearly defined in a mountainous than in a flat country, and we are dealing here with a mountainous region. Secondly, much of the criticism directed against any given life zone concept has had reference to the methods and criteria by which the zones were set up, leaving unchanged the basic fact that sharply defined and highly different associations do exist side by side. Again, much of the criticism of any life zone system has seemed to me fallacious in that it considers too narrow a portion of the biotic field. In a given region the bird life may be poorly zoned, whereas plant life, or even mammal life may show zonation much more clearly.

It should be made clear that references to zones in this paper consider them as associations of plant and animal life, not narrowed to the ornithological, or any other, field. For such associations the name *biome* has been proposed, and its use offers many advantages. The writer believes, however, that the more familiar *life zone* is justified, if it be remembered that the term carries broad sociological connotations.

Without reference, therefore, to the criteria by which zones have been separated, and with no brief for any particular zone system, Merriam's, Dice's, or any other, the fact remains that the mid-Allegheny region which this paper treats shows fair sized areas where the biota are definitely of the association which has been known as Carolinian, a much larger area which falls in the Alleghenian, and smaller, but in some cases sharply defined, territories where both fauna and flora are predominantly (if not purely) Canadian.

In our region only the larger valleys, notably the valleys of the Ohio and the New River-Great Kanawha River systems, are predominantly Carolinian. Among the warblers, only the Blue-winged and the Sycamore, with, perhaps, the Prothonotary, are restricted to this zone. However, Yellow, Cerulean, Prairie, Kentucky, and Pine Warblers, Yellow-breasted Chat, and Louisiana Water-thrush reach their greatest abundance here.

The forests of this region are predominantly southern mixed hardwoods, with considerable stands of scrub pine (*Pinus virginiana*) and pitch pine (*P. rigida*) on the more sterile hills. The picture is complicated, however, by occasional cold ravines where hemlock (*Tsuga canadensis*) and other more northern species are to be found, and in these may be found breeding warblers which normally occur only at higher elevations or latitudes.

If there be such a thing as the Alleghenian province of the Transition zone, our region represents it *par excellence*. Only a few years ago a prominent ornithologist stated in a national scientific meeting his belief that the Alleghenian is not a valid biotic division, in so far, at least, as birds are concerned. It seems to me that recent systematic work tends strongly to establish the opposite view. Such Alleghenian forms as Mountain Vireo, Cairns's Warbler, and Carolina Junco have long been known, while Burleigh has recently named the Southern Creeper (*Certhia familiaris nigrescens*) and the Southern Winter Wren (*Nannus troglodytes pullus*), and Dr. Oberholser has described a southern Appalachian race of the Black-capped Chickadee (*Penthestes atricapillus praticus*). It is true that the latter three are more common in the Canadian portion of the southern mountains, but they have apparently separated out in the general region under consideration.

By the very definition of the word, much of the mid-Allegheny territory falls marvelously well into a transition area. Where else may Yellow-breasted Chat and Mourning Warbler breed in the same

thicket, Black-throated Green Warbler and Cerulean Warbler nest in the same beech woods, and Louisiana Water-thrush and Northern Water-thrush find homes along the same stream?

In our territory Golden-winged Warbler (and perhaps Brewster's Warbler) seem to be restricted to the Alleghenian zone, while Worm-eating, Hooded, Black and White, Blackburnian, Parula, and Chestnut-sided Warblers, Oven-bird, and Redstart here reach their greatest abundance. Every breeding warbler known from the territory, save the two or three species previously mentioned as being restricted to the Carolinian, has been found in the Alleghenian.

The interesting association of breeding warblers (mentioned earlier in the paper) which has followed the death of American chestnut trees occurs almost exclusively in the Alleghenian province. Dense thickets which occur under standing dead chestnut trees are frequently made up of chestnut sprouts, rhododendron (*R. maximum*), mountain laurel (*Kalmia latifolia*), blackberries (*Rubus sp.*), scrub oak (*Quercus ilicifolia*), wild grapes (*Vitis sp.*), black locust (*Robinia pseudo-acacia*), and other scrubby growth. In these thickets Black and White, Golden-winged, Magnolia, Cairns's, Chestnut-sided, and Canada Warblers, Oven-bird, and Yellow-breasted Chat breed regularly, often in abundance. At higher elevations Mourning Warblers join this group, while at lower and intermediate elevations Hooded Warblers are common. Where there are living trees of some size Blackburnian Warblers and Redstarts are also abundant.

Thus we have ten or twelve warbler species regularly occupying a special type of habitat which must be new to them, at least on so extensive a scale.

At least two warblers of southern association, Hooded and Worm-eating, are more common in the Alleghenian than in the Carolinian portions of the territory which this paper discusses. This may well be due to the fact that suitable breeding habitats for these birds are more common at elevations slightly above the larger river valleys.

In the northern portion of the region under consideration the Alleghenian division of the Transition zone descends as low as 1000 feet elevation, and usually gives way to the Canadian at about 3500 feet. In the southeastern portion of the area the Alleghenian begins at about 1500 feet and ascends to 4000 feet or more. Dr. J. J. Murray and Professor Ruskin Freer do not consider that any of the Allegheny peaks in Virginia reach the Canadian zone. In Giles County, Virginia, near the southern extremity of our region, the Alleghenian begins at about 2000 feet, and points which rise to 4300 feet fail to show much evidence of a Canadian character.

Since by far the largest portion of the whole area under consideration lies between elevations of 1500 feet and 3500 feet, it can be

seen that the Alleghenian is the most extensive (and most significant) biotic division with which we have to deal.

Several types of forest occur within the area, and serve to show the striking 'transition' nature of the region. Southern mixed hardwoods, with some pitch pine, occur at the lower elevations, while stands of oak-chestnut-hickory come onto the dry ridges. Northern hardwoods (birch-beech-maple-basswood) are common above 2000 feet, and there are many coves where walnut and tulip poplar (*Liriodendron tulipifera*) are abundant. Hemlock is to be found along many streams, while on the eastern slopes of the Allegheny ridges there is a considerable stand of white pine (*Pinus strobus*). As rainfall decreases toward the eastern edge of the region scrub and pitch pines, and scrubby oaks become abundant.

Dr. J. J. Murray has recently published (1939c.) an excellent study of the Canadian zone (or modified Canadian zone) as it occurs in the southern Appalachians. He concludes that Virginia has no true Canadian zone territory, but believes that the high Allegheny ridges in Highland County (as well as the elevated Blue Ridge peaks near the North Carolina line) approach this zone. Western Maryland now has no Canadian area save, perhaps, the small portion of Cranesville Swamp which lies within Garrett County. This leaves, within the territory of this paper, only certain high mountainous areas in West Virginia to represent the Canadian, or modified Canadian, zone.

The original forest of red spruce (*Picea rubra*) pretty closely delimited the Canadian zone in West Virginia. Although the state once had over 700,000 acres in almost pure stand of this species, most of the spruce timber has been removed within the last fifty years. Clear cutting of the timber has all too frequently been followed by destructive fires, and spruce has been replaced, to a great extent, with hardwoods. Where this has occurred the Canadian character of the country has largely been lost, such areas now being clearly referable to the Alleghenian.

Fortunately, there is one considerable region where a combination of circumstances has acted to preserve the Canadian character of the country. This lies within Tucker, Randolph, and Pocahontas Counties, West Virginia, and includes a series of high mountain ridges and elevated plateaus known locally, and rather loosely, as Cheat Mountains. Actually the range is made up of Cheat Mountain, Shavers Mountain, Back Allegheny Mountain, and a number of other spurs and ridges.

Much of the Cheat Mountains area was lumbered under selective cutting methods, and fires in the region have not been extensive. With abundant rainfall (the nearest comparable station has recorded an average yearly precipitation of about sixty inches), reforestation of the original spruce has occurred extensively, and plant and animal life has

been subjected to a minimum of disturbance. About one hundred square miles of the Cheat section lie above 4000 feet, and there are extensive areas above 4500 feet. The maximum elevation is 4842 feet. The region is, perhaps, the nearest thing to a true Canadian forest which can be found in eastern North America south of the Catskills.

The high ridges of the Cheat Mountains catch the moisture-laden winds from the west, and a heavy precipitation results. Equally high ridges, notably Allegheny Backbone and Allegheny Front, which lie directly to the east are thrown into a rain shadow, and on these no extensive reforestation of Red Spruce has occurred. With the disappearance of the spruce, other Canadian species have also largely failed of survival.

Where red spruce within the Canadian zone does not occur in pure stands there are mixtures of spruce with yellow birch (*Betula lutea*), large-toothed aspen (*Populus grandidentata*), hemlock, and fir (*Abies sp.*)

In addition to the Cheat Mountains, there are several smaller areas where Canadian forms predominate. Cranberry Glades, Pocahontas County, is notable, as are Canaan Valley, Tucker County, and Cranesville Swamp, partly in Preston County, W. Va., and partly in Garrett County, Md.

No warblers, save possibly the Nashville, are restricted in our area to the Canadian zone, although Cairns's, Black-throated Green, Mourning, Canada, and Magnolia Warblers, and Northern Water-thrush here reach their greatest abundance. A much better idea of the bird life of the area can be secured if we list the following breeding species which are, generally speaking, restricted in this region to the Canadian: Saw-whet Owl, Olive-sided Flycatcher, Red-breasted Nuthatch, Brown Creeper, Winter Wren, Hermit and Olive-backed Thrushes, Golden-crowned Kinglet, and Purple Finch. To these might be added Pine Siskin and Red Crossbill, both of which have been observed in summer in the Cheat range.

In pure spruce forests not a single one of the warblers whose centers of abundance are to the south (i.e., Kentucky, Hooded, Cerulean) occurs.

RECENT SHIFTS IN BIRD POPULATIONS

Dr. W. C. Rives, pioneer student of the birds of the Virginias, states (1898),

" . . . I spent the period from June 4 to June 12, 1891, at Davis, [Tucker County, W. Va.] finding the general aspect similar to that of Maine or northern Wisconsin, rather than in accordance with one's preconceived ideas of a southern State, and the avifauna, as might have been anticipated, markedly Canadian and Alleghenian in character . . ."

On this and subsequent visits, Dr. Rives found large areas of virgin spruce still standing, but he notes that lumbering was well under way in the region. During a number of trips to the region he lists only

the following warblers: Black-throated Blue (noting that some were typical Cairns's), Magnolia, Black-throated Green, Chestnut-sided, Mourning, and Canada Warblers, Northern Water-thrush, and Maryland Yellow-throat. Of these he records that Chestnut-sided and Mourning Warblers were found in the clearings, not in the spruce forests, and that the Yellow-throat was not noted in 1891, but was observed in 1897. Thus, only five warbler species were found in the spruces.

In the years since Dr. Rives visited this portion of West Virginia the whole area has been lumbered by extremely destructive methods, and much of the land has been burned over. No substantial spruce reforestation has taken place, and most of the territory is now covered with a brushy deciduous growth. Despite the sharp vegetational transition, all of the warblers recorded by Dr. Rives may still be found in the neighborhood (some of them in rather restricted areas), and the following additional species have been noted: Black and White, Worm-eating, Golden-winged, Nashville (George M. Sutton and William Lunk), Parula, Yellow, Blackburnian, and Hooded Warblers, Louisiana Water-thrush, Oven-bird, Yellow-breasted Chat, and Redstart. It seems certain that Dr. Rives and his companions would not have overlooked all of these, and I believe it is a fair assumption that most, if not all, of these species have moved into the area since the original spruce was cut.

During the summer of 1914 an ornithological party camped for ten days along Shavers Fork of Cheat River, in Randolph County, W. Va. The notable thing about the whole experience was the abundance of a very few species of birds found in the dense red spruce forest, and the small number of species found. Our warbler list read much as did that made by Rives in an adjoining county, save that Chestnut-sided and Mourning Warblers, and Yellow-throat were absent. We did note Blackburnian Warblers.

Although this territory is in the Cheat range, where favorable lumbering methods obtained, and good spruce reforestation has occurred, warbler lists made during recent summers have included all species mentioned in the paragraph above, together with Black and White, Worm-eating, Parula, and Hooded Warblers, Oven-bird, Yellow-breasted Chat, and Redstart. It seems certain that most of the additional species are recent arrivals (as breeding birds) in the region.

Failure of the red spruce to reseed in the less abundantly watered mountains just to the east of the Cheat ranges has already been mentioned. In these, even at high altitudes, all warbler species previously noted as occurring in the Alleghenian zone may be found.

Just as many Alleghenian species have occupied territory once Canadian in its associations, so have species, predominantly Carolinian, been able to occupy parts of the Alleghenian. This movement of

southern association species has been particularly striking in central West Virginia. Within the last few years such species as Cerulean and Prairie Warbler, heretofore unknown in the territory, have become common breeding birds at French Creek, Upshur County, W. Va., at elevations from 1400 feet to 1800 feet.

As a result of the removal of the original forest stands, therefore, the Carolinian zone has been somewhat extended in the territory which this paper covers, the Alleghenian zone has been greatly enlarged, and the Canadian has been sharply reduced. As natural and artificial spruce reforestation takes place, the Canadian zone may increase in size, with a corresponding decrease in the size of the Alleghenian area. On public lands at least it is doubtful if clear cutting on so extensive a scale will ever again be the prevalent lumbering method. It will be a matter of interest for future ornithologists to note which of the changes mentioned above are temporary in nature, and which represent more permanent shifts in bird populations.

BREEDING WARBLERS IN THE REGION

In preparing notes on the warblers which breed in the central Alleghenies, two striking circumstances early became apparent. They are:

1. Certain warblers are to be found breeding here in habitats which are very different from those occupied in other portions of their ranges.
2. Many warbler species are here nesting in a greater variety of habitats within a single area than is, seemingly, the case in other portions of their ranges.

Notes on individual species which follow will demonstrate the basis for these conclusions. Reference might be made here to two striking examples; the Golden-winged Warbler which in Ohio and Michigan is restricted almost entirely to swampy areas, but which is abundant in West Virginia only on dry upland ridges; and to the Black-throated Green Warbler, breeding only in coniferous forest throughout most of its range, but nesting in a variety of deciduous associations as well in the central Allegheny region.

Mniotilta varia. Black and White Warbler. Resident at present throughout the region covered by this paper; formerly scarce or absent in the Canadian red spruce belt. This species reaches its greatest abundance at medium elevations in the Alleghenian zone, and is less common at lower elevations in the large river valleys. It is a characteristic bird of the "chestnut sprout" association. Recorded at elevations up to 4600 feet on Spruce Knob, Pendleton Co., W. Va.

Nesting dates: French Creek, Upshur Co., W. Va., May 24, 1926, four eggs (M. Brooks); Mt. Lake, Giles Co., Va., May 26, 1937, five eggs (D. R. Hostetter); Pleasants Co., W. Va., May 29, 1938, young birds (C. Conrad).

Protonotaria citrea. Prothonotary Warbler. There are very few records of this bird from our region and those few are largely uncertain. Doan (1888) reports a specimen taken near Buckhannon, Upshur Co., W. Va., on August 3, 1887,

but his collections have never been found, and much of his work is regarded as unreliable. Hicks (1935) states that the species is known to breed in Washington Co., Ohio (directly across the Ohio River from West Virginia), and it will probably be found nesting along some of the larger streams of the region with which this paper is concerned.

Limnothlypis swainsoni. Swainson's Warbler. Since the early days of American ornithology this little-known warbler has been considered a resident of the cane brakes and coastal swamps of the deep South. However, recent discoveries are forcing us to re-orient our thinking as to the species.

When Bibbee (1934) took an adult male Swainson's Warbler at Buzzard Rocks, Monongalia Co., W. Va., on June 14, 1924, his bird was regarded as of purely accidental occurrence, particularly as it was taken in a region of hemlock, rhododendron, and mountain laurel, only a few miles from the Pennsylvania border. Somewhat later, Mr. F. M. Jones, of Bristol, Tenn., collected a nest and eggs which he identified as of this species in the mountainous portion of southwestern Virginia, but, even with this evidence, the find was not accepted by ornithologists in general.

Williams (1935) called attention to the presence of the species near Tryon, in the mountains of western North Carolina, in May, 1934 and 1935. He notes that the birds were found in open places as well as in laurel thickets. During his work in West Virginia, Wetmore (1937) collected a male near Fourteen, Lincoln Co., at the swampy border of a little upland stream. Wetmore (1939) also collected a male, and observed two other individuals, in the mountains of eastern Tennessee, at elevations between 2600 feet and 3000 feet. He notes that they were in a swampy area heavily shaded by hemlock and rhododendron. Legg (1939) found birds which seem to have been of this species in rhododendron and mountain laurel thickets in Nicholas Co., W. Va., at points about three miles apart. Murray (1939b), in the light of other recent records, has accepted as valid the southwestern Virginia record made by Jones, and mentioned in the preceding paragraph.

With so much evidence at hand, it is becoming clear that a portion of the Swainson's Warbler population must be looked for over a wide area in the central and southern Appalachian region. Although Jones' nest is the only one actually recorded to date, there are so many additional summer records from the territory that the more extensive breeding of the species is strongly indicated.

Helmitheros vermivorus. Worm-eating Warbler. Distributed in regions of deciduous woods throughout the area; more common at lower elevations in the Alleghenian zone. It has not been recorded in the spruce belt, although it reaches elevations of 3600 feet in northern hardwoods association on the slopes of the Cheat mountains, Randolph Co., W. Va.

Nesting dates: Orlando, Lewis Co., W. Va., May 27, 1914, five eggs (E. A. Brooks); French Creek, Upshur Co., W. Va., May 24, 1917, five eggs (F. E. Brooks).

Vermivora chrysoptera. Golden-winged Warbler. As noted earlier in this paper, the Golden-winged is a characteristic bird of the dead chestnut ridges throughout the central Allegheny region. It is much less common in the larger river valleys, and has not been found in pure spruce stands, although Wetmore (1937) found it breeding at 3300 feet at Cranberry Glades, Pocahontas Co., W. Va.

Shunning the swamps which it frequents in other portions of its range, it is highly characteristic of the "chestnut sprout" association, where the males choose dead chestnuts for perches from which to sing. It is also fairly common in the pitch and scrub pine regions on the hills just back of the Ohio river, but becomes less common toward the eastern portion of the territory with which this paper deals. It ascends to at least 4000 feet in Giles Co., Va.

Nesting dates: French Creek, W. Va., May 30, 1919, five eggs (M. Brooks); Pleasants Co., W. Va., May 29, 1938, two young just out of nest (Tom Shields).

Vermivora pinus. Blue-winged Warbler. In our area seemingly restricted to the Carolinian zone in the lower river valleys. There are scattered migration records at points of higher altitude, but no actual breeding records. My notes indicate that these birds are locally common in the West Virginia counties along the Ohio River, but that they do not reach the eastern portions of the high Alleghenies. It is quite possible, however, that this view will require revision, since Sprunt (1930) found the species at elevations of 3000 feet in western North Carolina.

In the Ohio valley counties the birds inhabit mixed southern hardwoods, oak-hickory, and scrub pine areas. I do not know of their occurrence above 1200 feet. Males have a liking for dead trees as singing perches, a tendency in which they closely resemble the Golden-winged Warblers.

Nesting date: Cedar Rocks Country Club, Marshall Co., W. Va., June 10, 1932, four young (C. B. Upton).

Vermivora leucobronchialis. Brewster's Warbler. There are comparatively few places within our territory where Golden-winged and Blue-winged Warblers meet as breeding birds, and there are no actual nesting records for this warbler, or for the other hybrid. Lawrence's Warbler. Sutton has collected in Brooke Co., W. Va., a specimen of Brewster's Warbler which was in breeding condition, and Lunk (1938) tells of seeing a male Brewster's apparently feeding a young bird and associating with a female Golden-winged Warbler near Fairmont, Marion Co., W. Va. This bird, seen by a number of persons, occupied a brushy hillside throughout the summer. It sang regularly, and gave all indications of nesting in the neighborhood. If breeding actually occurred, it constitutes one of the most southern records for the species.

Vermivora ruficapilla ruficapilla. Nashville Warbler. Restricted in summer to the higher parts of the territory. It has been noted at Cranesville swamp, Preston Co., W. Va., by A. B. Brooks and Mr. and Mrs. Harold Roush, and in nearby parts of Garrett Co., Md., by Karl Haller and the writer. S. S. Dickey has reported it from Cranberry Glades, and is certain that it has bred in this locality. Dr. Sutton and Lunk have found it on Canaan mountain, Tucker Co., W. Va., the only place outside of an extensive swamp where it has been found in the region with which this paper deals. No nest has been recorded.

Compothlypis americana pusilla. Northern Parula Warbler. Specimens taken within our area have been referred to this race. The bird breeds locally in an astonishing variety of situations. It occurs in southern mixed hardwoods, in oak-hickory associations, in northern hardwood types, in oak-pine scrub, in hemlock ravines, in almost pure stands of white pine, and, at the edges at least, of spruce stands. I have seen nests in white oak and in sycamore (*Platanus occidentalis*). It occurs at 3500 feet on Elk Mountain, Pocahontas Co., W. Va.

Where there is standing live timber of some size, these birds are not uncommon in areas of dead chestnut, although the species should hardly be included in the "chestnut sprout" association.

Nesting dates: Dunkard Creek, Monongalia Co., W. Va., June 19, 1897, fragment of one egg in nest (J. W. Jacobs); French Creek, W. Va., May 29, 1916, four eggs (M. Brooks).

Dendroica aestiva aestiva. Eastern Yellow Warbler. Abundant in the river valleys; common in the lower parts of the Alleghenian zone, becoming less so at higher elevations. Not recorded in spruce forests. The species now occurs at Davis, Tucker Co., W. Va., at 3100 feet, an area that was in the original spruce belt as described by Rives (1898).

Nesting dates: French Creek, W. Va., May 24, 1919, five eggs (M. Brooks); Ice's Ferry, Monongalia Co., W. Va., May 17, 1935, four eggs (M. Brooks).

Dendroica magnolia. Magnolia Warbler. Common, often abundant, in Garrett County, Md., the mountainous counties of eastern West Virginia, and on the higher ridges of the Virginia counties which this paper discusses. The species shows a fairly wide choice of breeding habitats; it is found regularly in the "chestnut sprout" association, occurs in northern hardwood types, and is often abundant in virgin or second-growth spruce. Even on the comparatively dry eastern slopes of the Alleghenies (Pendleton Co., W. Va.) I have found the birds in summer at elevations as low as 1800 feet, in beech-maple forest. In Giles County, Virginia, the birds have been noted as low as 2500 feet.

Nesting date: Terra Alta, Preston Co., W. Va., June 24, 1933, four eggs (M. Brooks).

Dendroica caerulescens cairnsi. Cairns's Warbler. Common in western Maryland, the Virginia counties of this paper, and West Virginia counties with elevations above 2000 feet. Like the Magnolia Warbler, this bird is a characteristic resident of the "chestnut sprout" association, is found in northern hardwoods, and in spruce at all stages of growth. It is also found in white pine stands. Murray (1936) has noted the species at elevations of 1500 feet in Virginia, and I have seen it at 1600 feet in West Virginia.

Wetmore (1937) considers that all the specimens which he has seen from the region (with the possible exception of some from western Maryland) are referable to this race, although Hicks (in correspondence) was unable to distinguish any differences between specimens taken in Preston Co., W. Va., and Garrett Co., Md., and those from New Jersey and other more northern points. It is certainly true that some northern West Virginia birds could easily be referred to *D. c. caerulescens*. There is no sharp dividing line between the northern and southern races, the two meeting at points very near the northern boundary of the area which this paper discusses.

Nesting date: Terra Alta, W. Va., May 27, 1935, four eggs (M. Brooks).

Dendroica virens virens. Black-throated Green Warbler. This species, in its distribution within our area, presents one of the most puzzling problems with which we have to deal. It occurs everywhere at high elevations, in spruce, hemlock, northern hardwoods, white pine, oak-pine scrub, and oak-hickory. In Monongalia Co., W. Va., (in hemlock, along Cheat River) it nests at 1000 feet elevation, and Murray (1936) has found it at 1200 feet in Virginia.

Jumping over much of central and western West Virginia, it reappears at comparatively low altitudes (800-900 feet) in the scrub pine forests along the Ohio river. Hicks (1935) has pointed to a similar situation in Ohio, where the birds nest in a number of the unglaciated counties in the southeastern part of the state.

Since this species is so commonly thought of as being restricted in its breeding range to coniferous forest, it might be well to emphasize the fact that a number of West Virginia nests have been found in beech and other deciduous trees.

Nesting dates: French Creek, W. Va., June 2, 1926, four eggs (F. E. Brooks); French Creek, W. Va., June 11, 1933, three eggs (M. Brooks).

Dendroica cerulea. Cerulean Warbler. A characteristic bird of the counties along the Ohio river in West Virginia, rare or absent from western Maryland, the higher mountains in West Virginia, and the higher Virginia Alleghenies, but reappearing sparingly at lower elevations eastward. Murray (1936) and Freer (1939) have found it uncommon or rare in western Virginia at elevations up to 1200 or 1400 feet. This is one of the species which seems to be spreading into the Alleghenian zone in central West Virginia, since it has occurred regularly at French Creek (1700 feet elevation) in recent years. In fact, at this place Cerulean and Black-throated Green Warblers nest in the same small woodland.

To find the bird in maximum abundance however it is necessary to visit

the southern mixed hardwood and oak-hickory forests in west-central West Virginia. No other resident warbler sings regularly so late in the summer, and so persistently during the hottest parts of July and August days.

Nesting date: Jackson's Mill, Lewis Co., W. Va., July 27, 1936, four young (M. Brooks).

Dendroica fusca. Blackburnian Warbler. This species is equally at home in the lush spruce forests and on the dry, deciduous-forested Allegheny ridges within our territory. Like the Golden-winged Warbler, it often selects dead chestnut trees from which to sing. Murray and Freer report it as common above 1500 feet in western Virginia, with occasional birds found in summer as low as 1200 feet.

It does not occur over most of western West Virginia, but may breed locally in Hancock County, at the extreme tip of the state's Northern Panhandle.

Despite its abundance and wide distribution, I have no nesting records from the region of this paper.

Dendroica dominica albilora. Sycamore Warbler. Most of the records for this bird within our territory come from the larger river valleys, and we have no evidence of its having nested outside the Carolinian zone. Scott (1872) tells of a breeding pair taken by W. S. Edwards near Coalburg, Kanawha Co., W. Va., in July. A. B. Brooks and others have found the species in Ohio Co., W. Va., and Margolin and the writer have seen it in Kanawha and Mason Counties, W. Va.

C. O. Handley reports a bird seen on April 29, 1935, near Covington, Alleghany Co., Va., which he identified as a Yellow-throated Warbler (*D. d. dominica*).

No nesting data from the region under consideration are at hand, although Hicks (1935) states that Sycamore Warblers breed in Lawrence, Gallia, and Athens counties, Ohio. These counties adjoin West Virginia along the Ohio river.

Dendroica pensylvanica. Chestnut-sided Warbler. One of the most abundant warblers in mountainous cut-over areas. It is a characteristic bird of the "chestnut sprout" association, and reaches the edges of the spruce forests. In northern West Virginia it breeds down to 1200 feet, and it occurs up to 4800 feet where the habitat is suitable. Mountain laurel thickets offer a favorite nesting place, and dead chestnut trees are often used as singing places.

Absent from most of the western part of our region, the species reappears in northern Hancock County, W. Va.

Nesting dates: Lewisburg, Greenbrier Co., W. Va., June 12, 1913, one egg (C. O. Handley); Rawley Springs, Rockingham Co., Va., May 29, 1931, five eggs (M. Brooks).

Dendroica pinus pinus. Northern Pine Warbler. Found in the region of this paper wherever there are pine forests, from the Ohio river lowlands to the Allegheny crests at 4000 feet or more. I have not seen the species in summer in spruce, hemlock, or pure deciduous stands, although it is abundant in the oak-pine scrub of the eastern portions of the area. It seems to be distinctly less common in the white pine district than in stands of pitch pine or scrub pine.

Nesting date: Mt. Storm, Grant Co., W. Va., June 5, 1935, young birds (M. Brooks).

Dendroica discolor discolor. Northern Prairie Warbler. One of the species which seemingly has greatly extended its range within recent years. The Prairie Warbler is, with us at least, preeminently a bird of the brushy ridges, and the removal of the original forest has facilitated an increase in the breeding range of the species.

Occurring from the Ohio river to the eastern borders of the area under discussion, the birds skip over the heavily wooded mountains, but occur at 4000

feet on Potts mountain, Craig Co., Va., a comparatively dry and open locality. For some reason the range does not include northwestern West Virginia, where the species is rare, or not recorded.

Nesting dates: French Creek, W. Va., June 12, 1929, five eggs (F. E. Brooks); Pleasants Co., W. Va., May 29, 1938, three eggs (H. McGill and L. Tighe).

Seiurus aurocapillus. Oven-bird. One of the most abundant, and widely distributed, warblers of the Allegheny ridges, absent from the older spruce stands, and less common at lower elevations in the river valleys. There are some sections in the upper Ohio valley where the birds are unaccountably missing.

Oven-birds are to be found everywhere in the "chestnut sprout" association, and ascend to elevations above 4000 feet where the timber has been removed.

Nesting dates: French Creek, W. Va., May 21, 1928, five eggs (M. Brooks); Junior, Barbour Co., W. Va., May 26, 1930, five *pure white* eggs (F. E. Brooks); Mt. Lake, Giles Co., Va., May 23, 1937, five eggs (D. R. Hostetter).

Seiurus noveboracensis noveboracensis. Northern Water-thrush. This species, found along some of the mountain streams and in swamps at high altitudes, reaches its known southern breeding limits at Cranberry Glades, within the area with which this paper deals. It is confined to the Canadian and upper Alleghenian zones, nesting as low as 2500 feet at Cranesville swamp in West Virginia and Maryland. Eifrig (1933), writing of western Maryland, observes, "The same stream may harbor the Louisiana and Northern Water-thrushes as breeding birds. . . ."

These warblers show a preference for streams that are lined by spruce, hemlock, or rhododendron, or a combination of these, but they may occasionally be found in northern hardwood forest. Grinnell's Water-thrush (*S. n. notabilis*) has been taken in West Virginia during migration, but there is no present evidence to indicate its breeding within our area.

I have no local nesting data for Northern Water-thrush.

Seiurus motacilla. Louisiana Water-thrush. Normally the first migrant warbler to arrive in the spring, widely distributed below 3000 feet, and occurring sparingly up to 3500 feet. In the lower river valleys the birds seem less abundant, possibly due to a smaller number of suitable breeding habitats. In the lower and middle portions of the Alleghenian zone, however, there is scarcely a woodland stream without one or more pairs.

Nesting dates: French Creek, W. Va., April 19, 1935, three eggs (M. Brooks); Tomlinson's Run, Hancock Co., W. Va., June 5, 1938, two young (R. Murray).

Oporornis formosus. Kentucky Warbler. A common bird in the western portions of the area, absent from the spruce regions of the higher mountains, and becoming much less common on the eastern slopes of the Alleghenies. Wetmore (1937) found it in eastern Hardy County, W. Va., and there are a few western Virginia records. It occurs up to 3600 feet, in northern hardwoods, on Cheat mountain, Randolph County.

The birds seem at home in a number of forest types, southern mixed hardwoods, scrub and pitch pine mixtures, oak-hickory, and northern hardwoods. Nests are often placed close to the borders of a woodland trail or road. As with many other sylvan birds, ravines seem especially to attract them.

Nesting dates: French Creek, W. Va., May 19, 1926, four eggs (M. Brooks); Pleasants Co., W. Va., May 29, 1938, two nests, one with three and one with five eggs (B. Quantze, H. Bergner, R. West).

Oporornis philadelphia. Mourning Warbler. Resident in the higher portions of the area at least as far south as Cranberry Glades, W. Va., and Top of Allegheny, Highland Co., Va. Through western Maryland and northern West Virginia the line of distribution follows the 3000 foot contour mark with surprising accuracy. Cranberry Glades is the most southern known breeding station for the bird.

Mourning Warblers are completely at home in the higher parts of the "chestnut sprout" regions. Tangles of laurel and rhododendron, and blackberry thickets are often selected as nesting sites. The birds invade the edges of spruce cuttings, but are seldom found in stands of mature timber, either deciduous or coniferous.

Nesting date: Cheat Bridge, Randolph Co., W. Va., June 26, 1935, young birds (P. Wyss and R. West).

Geothlypis trichas brachidactyla. Northern Yellow-throat. Perhaps the most widely distributed warbler in the entire region. Since the spruce has been cut, Yellow-throats have invaded the highest mountains and are now abundant at all altitudes.

Wetmore (1937) concludes that the breeding birds (at least throughout most of our area) are of the present race, although he suggests that the Maryland Yellow-throat (*G. t. trichas*) may breed in extreme eastern West Virginia, just at the border of our territory.

Nesting dates: Pleasants Co., W. Va., May 30, 1935, one egg (T. Shields); Cranesville, Garrett Co., Md., June 3, 1935, five eggs (M. Brooks).

Icteria virens virens. Yellow-breasted Chat. Of surprisingly wide distribution; found in every part of the entire area except in heavy timber. Thickets of blackberry vines and black locust sprouts are favorite nesting sites. The birds are at home in the "chestnut sprout" association, even at comparatively high elevations. At Cranberry Glades they may be found nesting with such northern association species as Northern Water-thrush and Golden-crowned Kinglet. Murray (1939) records them from Middle mountain, Highland Co., Va., at 4000 feet.

Nesting dates: Warm Springs, Bath Co., Va., May 31, 1924, five eggs (M. Brooks); Covington, Alleghany Co., Va., June 1, 1926, four eggs (M. Brooks).

Wilson citrina. Hooded Warbler. These birds show a preference for areas of deciduous timber, light or heavy. They occur in southern mixed hardwoods, oak-hickory, northern hardwoods, and in "chestnut sprout" areas. On Cheat mountain they nest at 3500 feet, and in Giles Co., Va., they breed at 4000 feet. As with some of the other southern association warblers, these are somewhat less common in northwestern West Virginia.

Nesting dates: French Creek, W. Va., June 3, 1919, four eggs (F. E. Brooks); Rawley Springs, Rockingham Co., Va., May 30, 1929, three eggs (M. Brooks).

Wilsonia canadensis. Canada Warbler. A spruce belt species which has been able to adapt itself to cut-over areas, where it is now an abundant and characteristic bird of the "chestnut sprout" association. It also occurs in northern hardwoods at high elevations. In Preston county, W. Va., it nests at 2000 feet, and Murray (1936) lists it as abundant above 3000 feet in western Virginia. A favorite haunt is a ravine with dense hemlock overstory and an understory of tangled rhododendron.

Nesting dates: Terra Alta, W. Va., June 27, 1932, four eggs (R. West); Mt. Lake, Va., June 24, 1937, four eggs (D. R. Hostetter).

Setophaga ruticilla. American Redstart. Found at all elevations and in every major plant association in the area, but much less common at high elevations in the spruce belt. Probably did not occur at all in the original red spruce stands. The species is often an abundant one in the "chestnut sprout" association.

Nesting dates: Warwood, Ohio Co., Va., May 19, 1935, four eggs (H. Bergner); Pleasants Co., W. Va., May 30, 1935, four eggs (T. Shields).

SUMMARY

This paper presents an ecological discussion of the breeding warblers of the central Allegheny mountain region, the area including extreme western Maryland, West Virginia, and portions of western Virginia counties west of the Shenandoah valley, and south to the southern border of West Virginia.

Evidence is presented to show that breeding populations of birds in the area have had to face two critical problems within a very short time; the virtual destruction of all original timber stands, and the death of the American chestnut from the chestnut blight.

Chestnut sprouts, and other brushy growth, now occupy millions of acres of mountainous-country where, only a few years ago, virgin forests stood. The name "chestnut sprout" association is proposed for this temporary growth. In this association a highly diversified group of warblers breed. The group has representatives of both northern and southern affiliations, and includes Black and White, Golden-winged, Magnolia, Cairns's, Chestnut-sided, Mourning, Hooded, and Canada Warblers, Oven-bird, Yellow-breasted Chat, and Redstart.

The Carolinian, Alleghenian, and Canadian life zones, with their breeding warblers, are discussed, and evidence is given to show that the Alleghenian is the most extensive, and perhaps the most significant, biotic division of the area.

Range extensions of various warblers since the removal of the original timber are discussed, the discussion showing that many species have greatly increased the extent of their breeding grounds in the area.

Many warblers in the area under consideration nest in habitats which are strikingly different from those occupied in other portions of their breeding ranges. Also a number of species here occupy a greater variety of habitats than in other parts of their ranges.

Evidence is presented to show that a portion of the breeding population of Swainson's Warbler (*Limnothlypis swainsoni*) is to be found in the central and southern Appalachian mountain region, at elevations up to 3000 feet. Here it occupies hemlock and rhododendron thickets.

The breeding of 27 warbler species, with some additional races and one hybrid (Brewster's Warbler), is discussed.

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