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The first group of small songbirds to attract my attention as a photographer and student of birds were the wood warblers. Finding them and their nests very early became a game that challenged my sleuthing skill and all the woodcraft I had absorbed during my school days. It began on Great Spruce Head Island, Maine, during the mid-1930s, and by the end of the decade I was keeping a record of what I saw and found. In the spring of 1938 I identified eighteen warblers; several of these were transients, but nine others I knew to be residents because I had found their nests. In later years this number grew to twelve confirmed nesting species, with three or four presumed to nest, and the migrants bringing the total to twenty. The latest checklist of all nesting birds on Great Spruce Head and neighboring islands includes 66 species, and the total number recorded during the summer months is 95.

During those years of searching for nests on Great Spruce Head Island, I learned a good deal about the habits of some of the common warblers, their songs, scolding and chipping notes. I had discovered that certain species produced several versions of these. For example, the magnolia warbler utters a peculiar squeaky alarm note when disturbed by its nest; since it is not usually heard at any other times, it amounts to a sign that the bird is nesting and thus has led me to many nests. Another distinctive bird sound that I learned to recognize in Maine is the rasping scold note of the northern yellowthroat.

When I arrived in Maine on May 8, 1938¹—the earliest date in spring that I ever went there—the birch and alder buds were just beginning to open, and those on the spruces were still sealed in their brown papery caps. But the woods were buzzing with bird song, as the first

wave of spring migrants began arriving on the Maine coast, two hundred miles from Massachusetts. Many of these were represented by both sexes--an indication that the males do not always arrive first to stake out breeding territories. Many individual birds were merely pausing to refuel after a night's flight across the Bay of Maine before heading northward or fanning out over the mainland. Besides a number of blackpolls, Blackburnian, and black-throated blue warblers, and a sizable representation of many other species, the majority were myrtle warblers, black-throated greens, and parulas. During those years, these three were among the commonest breeding birds on the island, and some of those I saw that morning would certainly stay to rear their broods. On that same morning I heard both variations of the black-throated green warbler's song--a fact that seems to bring into question the significance of a distinctive song in connection with breeding. It has been observed that the black-throated green male sings one pattern when near the nest or in the presence of the female, and another--with a more aggressive purpose--at the boundaries of his territory or in confrontation with another male. Unmated males have been heard singing only the latter variation.

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A similar observation has been made concerning yellow and chestnut-sided warblers as well. In the presence of the female, both species sing a phrase accented at the end; as a territorial warning in the presence of another male of the same species, both sing a phrase without an end accent. Apparently many other warblers sing two or more distinctive songs, whose pattern is related to the reproduction process or to rivalry within or possibly between species. In Michigan, Betty Cottrille--with whom and her husband Powell I have spent many seasons studying and photographing birds in that state--has found that

the blue-winged warbler during nesting produced a song different from the usual territorial song, and ~~used~~^{used} the observation to great advantage in locating their nests.

On Great Spruce Head Island during the late 1930s, one of the commonest breeding warblers was the American redstart. At that time birds of this species inhabited the alder swamps and birch groves in much larger numbers than they do now. I found many nests simply by searching the young alders within a short radius of the singing perches of the males. They were usually built in vertical crotches of the smaller alders, the common elder, and saplings of the paper-bark birch—quite low down in the latter two, and seldom more than ten feet high in the alders. The nesting materials varied considerably according to what was available nearby; although the nests all contained silvery-gray plant fibers in their outer structure, some had incorporated shreds of birch bark or used that material as a foundation. Near our boathouse on the island, female redstarts were seen to pull out fibres from frayed manila rope or to pick up scraps of cotton waste, a byproduct used in those days to wipe up grease around marine engines. I have already mentioned one redstart's nest which I found neatly plated on the outside with bits of white tissue paper. Deer hair and that of other animals, commonly used as material for nest linings by many birds, was not available on the island. Here, the lining consisted of grass, rootlets and occasionally a few feathers.

Singing in defense of a breeding territory is almost exclusively an attribute of the male bird. In some species, notably the grosbeaks, both sexes do sing; in still others, an occasional singing female has been noted. But these are exceptions. Before I knew all this, I had observed what seemed to be female redstarts singing, and puzzled over

why there were so few of them. What I did not know was that male redstarts acquire their full adult plumage only in the second year; during the first year, male adults closely resemble females. This became clear enough when I discovered a nesting pair of redstarts, both of which appeared at first sight to be females. On closer observation, I noted that one, although without the glossy black plumage of the fully mature male, was nevertheless considerably darker than the other, with brighter yellow on the tail and wings.

With changes in the vegetation of the island, the nesting behavior of the redstart population has likewise changed. As the alders that had taken over the wetter parts of cleared land grew to large size, spruces began to fill in the upland meadows and pastures, young birch copses matured, and as smaller trees were overshadowed and died the woods became more open and freer of tangled undergrowth. Fewer birds nested in the aging alders; instead, they chose the birch groves and mixed growth of birch and spruce. Similarly, as the sproutland seedlings grew up and the number of nesting sites in young trees diminished, more nesting birds chose the higher branches of the birches. In 1968 and 1969, and again in 1971, a majority of the nests I found were at a height above fifteen feet, and many could be found on limbs as high as thirty feet above the ground, in tall birches growing at the edge of a clearing or away from other trees. It also appeared that because of the changing habitat the number of breeding redstarts on the island had declined--although this observation may simply reflect the greater difficulty in finding nests higher above the ground.

On the other hand, the adaptation by the redstarts to changed nesting conditions has made it easier to observe the behavior of an incubating female than at the lower level, when the thicker foliage

often cut off the view. So far as I have been able to observe, the incubation is done entirely by the female. During the thirteen days while she is thus occupied, she must leave the nest at frequent intervals to drink and forage for food. The male redstart does not feed the female on the nest as is customary among other bird families, the fringillids for example. When she leaves her eggs to search for food, she ranges rapidly through the open woods in the vicinity of the nest in the manner peculiar to an incubating female. She flits about nervously from branch to branch, picking up small insects and larvae from leaves and twigs, her tail fanned out and wings partly spread, continuously uttering sharp chipping sounds. It is these sounds that have frequently attracted my attention. The jerkiness of her flight, and the scolding notes, suggest an agitated attempt to focus the attention of a predator away from her vulnerable nest; and this is possibly the very purpose served by her actions. If she is kept in sight while thus engaged, which is never for very long, she can be followed back to the nest. Should one lose track of her, however, she can almost certainly be discovered again on a later feeding foray.

The parula warbler is unique among tree-nesting birds because of its nesting requirements. Its original nesting habitat appears to have been in the region of the Gulf of Mexico, where the trailing strands of an epiphytic plant commonly known as Spanish moss, found growing on liveoak trees, ~~was~~ used by warblers of this species to build their nests. With the northward withdrawal of the glaciers, the range of these birds spread gradually northward, and they discovered a comparable ecological niche in coniferous forests where the Usnea lichen or beard moss commonly grows. They use the strands of the lichen to construct pendent pouches among the clumps that festoon the spruce trees of northern forests, skillfully drawing the trailing filaments together underneath a branch

to form a durable sack. No other material is used, except now and then a few spears of grass for the lining. It might be expected that these nests would be found only in dense growths of the lichen; but quite often the entire mass is used, without leaving anything over by way of camouflage. Nests constructed in this way are easily spotted from the ground.

The nests built by black-throated green warblers are rather large, deep, thick-walled cups with a variety of natural components, including plant fibers, moss, and twigs, with finer materials worked into the interior. The outside is beautifully decorated with curly, papery strips of birch bark. Hair and feathers when available, thin grass stems, rootlets, and moss spore stalks are molded into a lining by the female as she shapes the nest with her body, pressing the sides out and causing the thick rim to curl slightly inward. The cup is so deep that during incubation the only parts of the bird visible are the top of her head, with the bill pointing upward, on one side, and her tail on the other. Black-throated green warblers generally place their nests near the outer end of a branch in a spruce tree where the foliage is thickest, and where the branch immediately above forms a roof and helps conceal the nest from view. From underneath, however, such a nest is quite noticeable because of the fragments of white birch bark. It may be placed anywhere from a few feet to thirty or more above the ground. Occasionally one may be found built close to the stem of a seedling spruce.

The myrtle and blackburnian warblers also build their nests in spruce trees, placing them well out from the trunk among the smaller branches. The nests of the two species are in many ways similar. Both are loosely built of small twigs, lichen fibers, and grass, sketchily lined with rootlets, spore stalks, and a few feathers, and are much shallower and less compact than the nest of the black-throated green

warbler. Myrtle warblers nest at a height of from fifteen to twenty feet, thus overlapping the height range of the black-throated green, but their foraging habits are said to be different. Blackburnian warblers choose a site forty feet or more above the ground, and do most of their food-gathering in the top branches of the same spruce trees. Field observers have suggested that the ecological niche occupied by blackburnian warblers may be defined by the height at which they forage, in addition to the parts of the foliage searched and their manner of doing it. Be that as it may, I found a blackburnian warbler's nest in Maine after I noticed both parents foraging near the ground and then watched them go to their nest high in a nearby tree. Conceivably they may be constrained by necessity to search for food over a larger territory while they are feeding their young.

The habitat of the magnolia warbler, another species of the genus Dendroica found in coniferous forests, is somewhat different from those just described. Magnolia warblers prefer the edges and cleared areas of the spruce forest, where young evergreen are growing up to replace older trees that have been cut or blown down. Their nests are always built fairly low in the wall of green branches spreading out into the light from the forest boundary, ^{close to the ground} or among the crowded seedlings of balsam and spruce that have sprung up in glades open to the sun. As you enter one of these miniature groves, pushing your way slowly through places where the growth is least dense, a squeaky, protesting note is a certain indication that a magnolia warbler has been frightened from her nest. A careful search, gently raising the top branches of the bushier seedlings, or merely the sight of a few projecting straws, may betray its location. The nest is a rather flimsy affair, consisting of a shallow depression on a foundation of dry grass and straw, with a lining of other, finer grasses. The golden spore stalks of cranebill and other

mosses are arranged in a circle around the inside, intermixed with a woven layer of slender black rootlets which form the bottom. This structure seems to be the same wherever the magnolia warbler is a breeding resident. I have found nests exactly like this all the way from New England westward into the upper peninsula of Michigan and the Quetico-Superior region of Minnesota, and northward from Lake Superior to Lake Nipigon in Ontario.

Much of my pursuit of birds in Michigan and Minnesota has been in the company of Powell and Betty Cottrille of Jackson, Michigan. Our friendship goes back to the spring of 1955, when we spent several weeks together near the Seney Federal Wildlife Reserve in the Upper Peninsula. I had gone there to photograph warblers in the company of Bill Dyer and Dr. Lawrence Walkinshaw, the noted specialist on sandhill cranes. ^{with} It was/Larry Walkinshaw that I first visited the habitat of the Kirtland's warbler in central Michigan, as long ago as 1946 and 1947. He had shown me ^a ~~the first recorded nest~~ of the Kirtland's warbler ~~nest~~ near Lovells, where I photographed the bird, as well as prairie warblers and clay-colored sparrows. My long association with Michigan began with an introduction from the National Audubon Society to Ed Brigham II in Battle Creek, where the Brighams took me into the family circle and introduced me to their friends among the ornithologists of the region. It was at this time that my interest in bird photography and my obsession with wood warblers were crystallized.

During that visit in 1955, we made our headquarters at a rustic lodge halfway between Seney and Grand Marais on Lake Superior. For three weeks we went out daily, regardless of the weather—and most of the time it was bad—to explore upland hardwood forests and black spruce bogs in search of nesting birds. Besides waterproof clothes

and rubber boots, we wore head nets as a protection against blackflies. Walkinshaw and the Cottrilles were very good at finding nests in the rain, and on the few good days we divided up to photograph what we had found. Although Powell Cottrille always managed to display a nonchalant attitude toward our daily adventures and tribulations, the competition among the rest of us was intense, as though our very careers depended on finding more nests than anyone else. It was here that I obtained my first pictures of the Nashville and Western palm warblers.

In 1959 I persuaded the Cottrilles to join me for a month in southern Arizona to photograph Southwestern warblers. We met early in May at the Southwestern Research Station of the American Museum of Natural History on Cave Creek in the Chiricahua Mountains, where I had made arrangements for a month's stay. The birds we hoped to find were the red-faced warbler, the painted redstart, the olive warbler, and the Grace's warbler. Before I left the Research Station in June I had photographed them all, as well as three varieties of hummingbirds native to the Sonora Desert—the blue-throated, Rivoli's and violet-crowned.

~~At Tucson~~ I had photographed birds in the desert around Tucson, Arizona ^{in previous years} but for bird photography in May and June ~~of the year before~~; this trip was by far the most productive I had made to the Southwest.

After the success of the Chiricahua trip, the Cottrilles and I looked forward to working together again the following year. Aside from the pleasure our continued association gave me, the advantage was undeniably greater for me than for Betty and Powell since they outnumbered me two to one, not to mention their remarkable skill at finding nests. By now I had photographed thirty species of American warblers, or about half the total number found north of Mexico, and was wholeheartedly committed to photographing as many as I possibly could of the rest. Several that are common in southern Michigan were among them: the golden-winged warbler and its hybrids with the blue-winged

species, and the cerulean warbler.

Finding and photographing a nesting cerulean warbler constitutes a special challenge. Its habitat is the upper branches and leafy crowns of bread-leafed deciduous trees in hardwood forests. Here ^{warblers} ~~these~~ sing, forage, and build their nests, seldom at a height of less than forty feet and often as high as sixty feet. Surrounded as they are by leaves, this height makes them hard to see and harder to follow; and even should one's persistence be rewarded, the discovery of a nest is only the beginning of an enormous amount of planning and effort before a camera can be placed near enough to make successful photography possible.

All these difficulties notwithstanding, we had decided that the reward of success would be great enough to justify almost any amount of time and effort, and so we agreed to go after cerulean warblers in the spring of 1960. I arrived at ^{C. S. Hume} ~~their~~ home in Jackson, Michigan on May 20, and on the next day I found one of the sought-for warblers building a nest at about sixty feet above the ground in the oak woods not far from the ^{Hume} ~~Cottrills~~ house. The nest was saddled far out on a long horizontal branch, above a clear space in the woods with no branches or smaller trees below it. If this was a typical nesting site, our prospects were poor indeed, since the construction of a very high tower, a project calling for a considerable cost and great effort, would be necessary to photograph the birds that had chosen it.

So we decided to look for a more conveniently located nest, and in this we were extremely fortunate. On May 22, as we explored a small bird sanctuary near Jackson, we saw a cerulean warbler pulling bits of lichen from the trunk of a tree not more than fifteen feet above the ground. Knowing immediately what that meant, we froze our attention on the bird while she—for it appeared to be a female—continued pulling at the lichen for a few seconds more and then flew upward at an angle

of about thirty degrees. The steepness of her flight suggested that the nest she was building was not far away. Following the direction she had taken, we moved with suppressed excitement--and Powell was even able to assume an attitude of indifference--~~we moved~~ through the woods, each of us selecting a likely tree and proceeding to examine it carefully from the top downward for the warbler or any sign of a nest. We did not see the warbler ~~herself~~ until we went back to where we had first seen her. There she was, again pulling at the lichen. Once more she flew off in the same direction, and once more we followed her, focusing our attention on a large basswood tree that appeared to be in her line of flight. We were standing around the base of this tree, peering up through our binoculars, when Powell announced in a nonchalant, almost bored tone that he saw her and that she was on a nest. And once we had seen it, there could be no doubt about the nest--a gray, knotlike construction resembling that of a gnatcatcher, placed on a slightly upturned limb, not far out from the trunk of the tree, at a point where a tuft of broad new leaves had sprouted to form a sheltering canopy. We judged the height to be above forty feet above the ground, and later measured it at forty-five.

We saw immediately that it ^{would be} ~~was~~ quite possible to photograph ^{the} birds at this nest by setting up a tower, at a height of not less than five feet below the level of the nest. After discussing ways and means, we decided to rent the requisite ^{quantity} ~~number~~ of metal scaffolding from a contractor. During the days that followed, I leveled off a place on the ground where the tower was to be set up. Then there was nothing more to be done except to wait until the eggs had been laid and hatched. The laying would take four days, assuming the usual number and practice of laying on successive days. Although the incubation period for the cerulean warbler has never been precisely determined, we put it at

about twelve or thirteen days, the period for other warblers for the same genus. Thus, allowing three more days for the completion of the ~~and~~ nest, ^{and} four days for egg-laying, with incubation beginning of May 25, and thirteen days more for hatching the eggs, plus two or three days more so as to give the young birds time to develop the strength necessary to withstand the extra exposure caused by our activities, we could expect to begin photographing around June 14. The scaffold could be set up two or three days before that.

With more than two weeks to devote to other birds, we located among us a large number of nests--those of a golden-winged ¹and a blue-winged warbler, a chat, and a yellow warbler, as well as of an Acadian flycatcher, a short-billed marsh wren, a rose-breasted grosbeak, and many other common birds. The bird that interested me most was the golden-winged warbler, which I had found building a nest a day or two after Powell had found the cerulean. But the blue-winged warbler, which Betty discovered, was equally advanced and ready to photograph at the same time.

Meanwhile, Powell and I had set up all but the top section of the scaffolding by the cerulean warbler's nest. On June 12 we saw the adults carrying food and knew that the eggs had hatched, and on the next day we completed the scaffolding and set a platform of planks on top. As I stood there with my shoulders on a level with the nest, the female, after being frightened off by our activity, returned with food and settled over her young to brood as soon as they had been fed. When I reached over to find out how she would react to my hand, she didn't budge. Withdrawing, I watched for a while as she adjusted her position on the nest. Presently the male came and gave her a green caterpillar--¹which, backing off onto the edge of the nest, she then fed to one of their young. All this seemed almost too good to be true. It would appear that unlike many ground-nesting

species, the cerulean warbler has not been conditioned to react to the danger presented by large mammals, including human beings, and is therefore all but fearless when confronted with them.

It rained the next day, and the weather on June 14 was still unsettled—but not bad enough, I concluded, to rule out photography. Since the Cottrilles preferred to wait for better weather, I decided to have a go at it alone. Hauling my equipment onto the platform with a rope, I found that the warblers continued to go about their domestic affairs with little apparent concern. I made photographs intermittently between showers, and when the rain was too heavy I would cover up my camera and power packs with waterproof sheets until it was possible to go on. Although conditions were so unfavorable, I was able to take a number of pictures. While I was thus occupied, I noticed that although the nest including lichens, was made of plant materials, and possibly of spiderweb, which one would expect to become water-soaked and soggy, it was in fact impervious to water. Since lichens are known to change from a brittle to a flexible state after absorbing water, I expected the nest to be soft to the touch. To my surprise, I found that it was hard and stiff, as though cemented together on the outside with some impervious glue as the sticks that make up a chimney swift's nest are. Do cerulean warblers also produce a salivary secretion as a bonding material? It would seem that in their preferred site in the high forest canopy, on the exposed surface of a branch where no anchoring twigs are available, some kind of adhesive must be necessary to hold the nest in place against the dislodging effect of wind and rain.

We were all able to photograph the cerulean warblers several times. The last time I did so was on June 18, when the young were still several days from fledging. By then the peak of the nesting ^{season} region for most

from the dry poplar ridges in southern Alberta where ^{in 1926 had} Taverner found it to be a common nesting species, or from the hardwood forest terrain of northern Michigan. ^{had} We heard one singing in the Quetico-Superior region near Ely ~~On~~ June 25, 1961, and a year later we heard another in the same spruce and tamarack bog. This time ~~the~~ Connecticut warbler had top priority on our list of birds to be photographed. In almost every black spruce-^Ntamarack bog we visited after mid-June, we would hear its characteristic song, whose loud and throaty character is not unlike that of the mourning warbler. As the days passed, however, the prospect of finding a nest appeared increasingly remote—until July 4, when the sound of a police whistle (we each carried one as a means of calling for assistance) brought Betty and me to where Powell was working alone. He had stirred up a Connecticut warbler, which was giving the loud whip or whik we had become familiar with in Michigan. Soon we saw both birds of a pair, one of them carrying food. The male differs from the female in having a capelike hood of a slightly darker gray, though the difference is less distinctive than in the mourning warbler. The characteristic mark of the Connecticut warbler is an unbroken white eye ring—a feature not found in the mourning warbler, although a female of this species which I later photographed did have such a ring, faint but still distinct.

While we watched, the birds flew repeatedly, one after the other, to one of several small ^{trees} larch ~~which~~ which were growing at wide intervals in the area. We were unable to ~~keep~~ continual track of both birds at once. Now and then one or the other would appear unexpectedly on a branch, walk toward the end, and stand looking down for minutes as birds do when they are preparing to take off from a perch. Eventually it would either fly to the ground and vanish into the bog vegetation, or fly off to another perch and go through the same performance. Once the bird had dropped to the ground, we would lose track of it entirely until it

reappeared in one of the trees, scolding or carrying food. A careful search of all likely places for yards around the place where the bird had alighted in the bog got us nowhere, though we began to suspect that the behavior of the ^{old birds} ~~birds~~ meant young birds scattered through the bog vegetation rather than a nest.

As the morning wore on, it began to rain and we were cold. Leaving Powell and me to keep watch, Betty went back to the cars for sandwiches and coffee. We had hardly started eating when Powell stood up, without saying a word, walked about fifty feet to a hummock like the one he had been sitting on, separated the leaves and grass growing on it, and said with calculated indifference, "You don't have to look any further. Here it is." He had ^{noticed} ~~seen~~ a slight movement among some blueberry leaves, without seeing a bird enter or leave the site. The nest he had found contained four young, well feathered and looking as though they might jump out at any moment. Standing back to observe the adults, we saw them creep through the tangled plants for a distance of many yards from the place where they dropped to the ground. Then, after feeding their young, they walked stealthily away again, sometimes as far as to one of the tamaracks, in which they would then perch once more.

The nest, beautifully concealed in a hollow in the hummock, was made visible only by parting the vegetation that covered it completely. Above the hollow grew a miniature blueberry bush; leatherleaf grew over one side, and the long, thin ribbons of sedge and marsh grass hung down over the other. A mound of mixed sphagnum and cranebill moss, curving out from under the nest, gave it still further protection. Laced through the moss were tiny, flat-leaved snowberry vines and the long, tough stems of lycopodium. More grasses—old brown blades together with the season's new growth—trailed out from the clump of moss. The nest, inside its mossy bed, was made entirely of dry grass. When the adult birds ap-

proached, they came through a tunnel of leatherleaf, grass, and Labrador tea.

By now the rain had settled down to a steady drizzle. All the same, I decided to try photographing the nest, since the young birds would clearly be leaving it soon. Two years ago in Michigan, the Cotgrilles had obtained photographs of Connecticut warblers and I hadn't. Since they were not eager to try for pictures in the rain, I made the first try, using waterproof plastic to protect the camera and electronic components and working from a blind. The birds adjusted to the camera and lights very quickly, and were soon feeding their young normally. The bad weather had conferred an unforeseen advantage: it undoubtedly deterred the young from leaving the shelter of the nest, as sunny weather combined with the disturbance of human visitors would certainly have prompted them to do. This is just what happened the following day, and I returned to take more photographs when the weather improved: as the temperature rose and the vegetation dried off, the young birds became increasingly restless, and before noon they had left the nest. As it turned out, the pictures taken in the rain were the best of the lot.

In the meantime, we had become almost as eager to photograph the less rare but still more furtive member of the genus Oporornis, the mourning warbler. Birds of this species have a disquieting habit of deserting their nests if they are disturbed during the building stage of before the eggs are laid. We had already found two nests under construction and both had subsequently been deserted; so when Betty found a third, just finished, we stayed strictly away, keeping track of it only with field glasses from as far away as possible. It was not until after Betty and Powell had gone back to Jackson that I succeeded in photographing this bird. Because it was so late a breeder

I had stayed over an extra week for this purpose; but I managed to obtain photographs only of the female.

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This part precedes the Gm. W.

In the summer of 1961, encouraged by our success in Michigan the year before, we had begun with a more ambitious expedition into Canada north of the Great Lakes, the heartland of the sub-boreal breeding warblers. We had our sights set on the Tennessee and Cape May warblers, whose breeding range extends from northern New England, Michigan, and Minnesota northward as far as Alaska. In the United States the nesting records of these species are few and widely scattered, and we had concluded that our best chance to find breeding birds would be in Canada. Starting out from Jackson on June 12, we crossed into Canada at Sault Sainte Marie and drove along the north shore of Lake Superior, through beautiful, wild, rocky country I found reminiscent of the coast of Maine. This part of Ontario was scarcely populated, the few settlements on Lake Superior depending for their existence largely on the pulpwood industry. To the northeast lay the broken, rock-ribbed land of the Canadian Shield, whose stunted spruce forest stretched uninterrupted for hundreds of miles. The only break in this vast wilderness was made by the thin steel ribbons of the trans-Canadian railroads.

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On June 14 we reached Nipigon, where logs for pulpwood are floated southward ^{on} the Nipigon and Black Sturgeon rivers, which drain into Lake Superior. It was in the area around Nipigon that Charles Kendeigh had made a study of the relation between spruce budworm infestations and breeding bird populations, showing that the number of arboreal-nesting warblers increased wherever a plague of the insects occurred. According to the study, ^{One of} the commonest birds in the region, where a budworm outbreak had been rampant for several years, was the Cape May warbler.

We signed in at the Black Sturgeon River Lodge and set out to explore

the region he had described. Since the region for hundreds of square miles was laced with logging roads, it was possible for us to cover a good deal of ground. Several years before, the spruce forest had been clear-cut for long distances in every direction, and poplar trees were springing up to replace it. With the cutting of the spruce trees, the budworm had been eliminated and the Cape May warblers, deprived of both food and habitat, had also gone. Obviously our search for this species was not going to be successful here. But there still remained the Tennessee warbler, and to look for it we shifted to swampy places that had not been disturbed by lumbering.

On our second day, we found in a black spruce-sphagnum bog a pair of Tennessee warblers whose behavior gave every indication that they must be nesting somewhere nearby. After following them around for several hours, Betty and Powell simultaneously spotted the nest. Sunk in the side of a mound of moss and woody shrubs, it contained five eggs. Despite this find, however, after another day's work in the field we had found so little in the way of nests that we decided reluctantly to leave Canada for the Quetico-Superior lake country in northern Minnesota.

At Pine Point Lodge near Ely, we were able to rent a cabin for a month. We soon discovered that birds of all kinds were everywhere, including all the common species of warblers. We soon concluded that their numbers were probably related to a budworm plague that had infested this part of Minnesota for several years--in some places so heavily that young balsams had been killed by complete defoliation. The larger trees appeared to be less vulnerable and to have suffered less damage by the insects. On inquiring, we learned that the Department of Agriculture had sprayed the forest with DDT in several past seasons but had finally given up in despair, leaving control of the plague to the birds.

By the end of our second day, we had explored a black spruce-tamarack

bog and found three nests of Tennessee warblers, all containing eggs. The sites of all three were much the same: a sphagnum hummock or an old stump so overgrown with ^{grasses,} club moss, snowberry and twinflower vines as to be almost unrecognizable. Cape May warblers were also present in the bog, along with Nashville, myrtle, parula, and magnolia warblers, white-throated sparrows, cedar waxwings, boreal chickadees, winter wrens, and olive-sided flycatchers—to mention only some of the birds we saw in those first two days.

The principal difficulty we encountered in the bog was the swarms of mosquitoes and blackflies. They rose in such clouds that head nets were essential most of the time, making the use of binoculars awkward to say the least, and at times impossible. Mosquitoes can generally be discouraged by the use of repellants or reasonably impervious clothing; but not so the blackflies, of which the best thing that can be said is that they carry no disease. Liquid repellants and noxious ointments do little to deter them. To keep them from biting, trousers must be tucked into the tops of boots, jackets must be tight about the waist, zippers must be closed up to the chin, sleeve cuffs must be buttoned and covered by gauntleted gloves, and a broad-brimmed hat must be covered with a fine mesh head net hanging well onto the shoulders and pinned to the jacket. Even thus attired, you may not escape being bitten.

*Mnecht
BF. edited*

A spruce bog on a sunny June day can be a sultry and oppressive place—especially for one ^{wearing} the recommended attire—but it is also beautiful. The trees stand singly or in small groups about its shrinking perimeter—mainly black spruce and larch, but with an occasional, taller white spruce. The billowy open surface of the bog is white with the blossoms of Labrador tea, which gives the impression of being by far the most abundant single plant—although leatherleaf and cottongrass, along with other woody bushes, are also numerous. In the early morning

light, the dense white blossoms appear dazzling as frost, and the halo-like gleam of the low sunlight reflected by the needles of the spruces adds to the wintry visual impression. All this brilliance slowly subsides as the day advances, and the appearance of the bog becomes more commonplace. On the higher ground surrounding the bog, the trees of the mixed forest are larger and older, and the June air is perfumed by the thousands of pink twinflowers that carpet the forest floor, interspersed with the whiteness of bunchberry and wild lily of the valley.

It was in this setting that we finally tracked down the bird we were most eager to find. For several days we had been seeing Cape May warblers, but they had all been males and we kept losing track of them. Then, on June 25, ^{Betty} ~~we~~ saw one carrying food. On the next day we also saw a bay-breasted warbler, but what excited us most was Betty's announcement that she had again seen a Cape May warbler with food. We converged on the spot, and after two hours during which we noted and identified every bird that moved, Betty finally discovered the nest—only three and a half feet from the top of a black spruce twenty feet high, built close to the trunk. The unusual behavior of the Cape May warblers accounted for our failure to spot it sooner. They do not fly directly either to the nest or to the nest tree, but approach at a low level, usually going first to a nearby tree, then to the lower branches of the nest tree. They move upward close to the trunk until they reach the level of the nest, then walk out onto the end of a branch to inspect the surroundings before going back to feed the young. On leaving the nest, the birds rarely fly out horizontally but instead dive for the ground before flying away. In the nest tree, Cape May warblers do not hop or jump, but walk on the branches in the manner of the Connecticut warblers we had observed in Michigan the year before. The female was much more timid and hesitant

than the male in her approach to the nest, often waiting for many minutes only a few feet from it before getting up courage to feed her young. Now it was clear why these birds had been so difficult to follow after we saw them carrying food.

Using a ladder to climb to the nest, I found that it contained eight young birds about five days old, with their eyes open. The only possible way to photograph them appeared to be by lowering the tree, and we decided to begin the lowering immediately. Fortunately the nest tree was rather thin, with soft, weak branches, and thus not too heavy to manage easily. Cutting a gin pole and lashing it to the bottom of the tree, we ran a rope through a pulley at the top, halfway up the trunk, and then sawed through the trunk at about four feet above the ground, lowered the top and fastened it firmly both to the pole and to its own stump. The response of both birds to the maneuver was cautious. The female made one trip straight to the nest and fed the young. On her second visit, after a long interval, she landed below the nest, moved up part of the way, and then remained motionless for many minutes before flying out again. The male eventually came with food, climbed the tree in the usual way, and stayed on the nest. Late in the afternoon we left, hoping for the best.

Next morning we found both birds actively feeding the young. They now accepted the changes as we lowered the nest three feet at a time, cutting sections off the lower end of the trunk and shortening the pole to which it was tied at the same time, until we had brought the nest to a height of six feet above the ground. The female, however, still behaved somewhat more timidly than the male. Both adults were feeding the young mainly on budworms, although now and then the male brought a dragonfly. They came with their beaks full of worms¹--from four to six at once, to be distributed among several of their eight offspring. Clearly the budworm infestation was a bonanza for Cape May warblers in the area. As it was

brought under control, the success of the birds in breeding would gradually decline, and in future years fewer Cape May warblers would return to the Minnesota bogs. Where they went would depend on food supplies elsewhere, and if they failed elsewhere the numbers of the species might diminish.

Our success in photographing two new warblers, the Cape May and the Tennessee, and the abundance of so many others, persuaded us to return to Minnesota the following year. ~~By the time~~ I arrived on June 15, 1962, and two days later when the Cottrilles joined me in Ely, I had already found the nests of a Tennessee and a Canada warbler. Two days later, we had found four more Tennessee warbler nests, two of them in the same sites as the year before—presumptive evidence that they were the same pairs. The number of nests we found altogether was still larger than the year before, and very soon we had a larger backlog of them than we could hope to photograph: yellow-bellied flycatchers, cedar waxwings, red-eyed vireos, white-throated sparrows, and several warblers including the Nashville and chestnut-sided. A week after our arrival, we were back in our favorite spruce and tamarack bog, tracking down the Connecticut warbler which we eventually photographed, when our attention was drawn by the high, sibilant buzz of a bay-breasted warbler. The bird was not far from where I stood, and we all saw him. It was Powell who followed him to a clump of black spruces and discovered the nest, ten feet up in a twelve-foot tree, with five eggs in it. Now our only worry was over whether predators would destroy the nest before the eggs hatched and we could get our photographs. The eggs did hatch, and on July 6, when the young were three days old, I photographed them. With this done, the goal we had set had been accomplished.

But that was not all. Every season has its dividends. That year they included chestnut-sided, Canada, and yellow warblers, ovenbirds, red-eyed vireos, rose-breasted grosbeaks, phoebes, yellow-bellied

flycatchers, veeries, and Swainson's thrushes, not to mention the mourning warbler female of which I succeeded in obtaining photographs that year after the Cottrilles had left. On my way home to Santa Fe I stopped off in Gold Hill, Colorado, where my son Jonathan was living, and spent several days photographing pileolated warblers that were nesting in an alpine meadow below Mt. Audubon in the Rockies.

In late May of 1963, I joined the Cottrilles in Cincinnati for a try at photographing such warblers as the hooded, Kentucky, and worm-eating, which nest in more southerly regions. Working in the Miami-White Water Ohio State Forest, where Ronald Austing, the well-known raptor photographer, is superintendent, we did find the first two species but not the last, although the birds were not uncommon in the area. The dividends that year were Louisiana water thrushes, wood thrushes, blue-gray gnatcatchers, yellow-breasted chats, and white-eyed vireos. Our failure to find a nest of the worm-eating warbler rankled so much that two years later we tried again (in 1964 I was in the ^{Baja California} ~~Galapagos Islands~~)—this time in southern Indiana, but again without success because we were too early. The birds were plentiful enough in the state forest where we worked, but while we were there during the second week in June they were just beginning to establish their territories and build their nests. Meanwhile, we had plans to go north to the Connecticut Lakes region of New Hampshire to photograph blackpoll warblers. A few years later, the Cottrilles visited Kanawha State Park near Charleston, West Virginia, still in search of nesting worm-eating warblers, ^{and} found fledglings but no nests. It was not until 1971, when I visited the same park in late May—having profited by their experience—that I found two nests and at last obtained photographs of the birds at both of them.

The Connecticut Lakes region, where I was able to photograph at

two blackpoll warblers' nests—one in a spiraea bush and the other in the more typical site, a spruce seedling—lies just below the Canadian border, where the Connecticut River ^{rises} has its rise. It is a region of clear trout streams, small lakes, and low hills deposited by the continental ice sheet. Birds of the Canadian zone are numerous here; besides the blackpoll and the Philadelphia vireo, for which the region is particularly noted among ornithologists, they include Wilson's, magnolia, black-throated green, Canada, ^{and} Nashville warblers, redstarts, Northern water thrushes, and yellowthroats.

breed
 Since moving my family permanently to New Mexico in 1946, I have come to know the birds of that state from the willow thickets of the Rio Grande and its tributary watercourses to the alpine meadows of the Sangre de Cristo range. In the juniper-pⁱⁿon forest that covers the low foothills of that range, the only warbler to breed is the black-throated gray. In June this species is not uncommon there, and its buzzy song— ^{similar} ~~reminiscent~~ in quality though not in pattern of that of the black-throated green warbler— ^{may} be heard as the males demarcate their respective breeding territories. ^{II} The black-throated gray and black-throated green warblers, together with the golden-cheeked, ^{Townsend's} hermit, and ^{Hermit} Townsend's warbler, are thought to have evolved from a common prototype ^{advance and} during the retreat of the last of the Quaternary ice sheets, ^{during several over a period of} some twenty thousand years ago. *hunched* It may have been then that the present migration patterns for many kinds of birds were first established—patterns that for some species continue to shift even to this day. The five species just mentioned all winter in Mexico and Central America north of the Isthmus of Panama. Their postulated ancestor would have been a tropical species, as all members of the wood warbler family are by genetic origin. *advance* With the withdrawal of the ice sheet, the gradual northward movement

into what is now the United States would have led to the establishment of more or less distinct local populations, which each winter would have been driven by the cold back toward their ancestral home. With the slow warming of the continent, these ^{the recent times} fluctuating movements would gradually have lengthened into definite routes for each/separate populations, until a migration pattern became part of its genetic heritage.

Of these populations, one emigrating to the northeast—New England, New York State, and the Great Lakes country—became, the black-throated green warbler, while ^{the one that is now} the black-throated gray warbler traveled north ^{into} along the eastern escarpment of the Rocky Mountains. A third group, ^{the mountainous} the hermit warbler, spread westward to reach the Pacific and moved up the coast to Oregon and Washington, with the barrier of the Rockies cutting off contact with the population to the east. A fourth population, the ancestors of the Townsend's warbler, eventually extended its range all the way northward to southern Alaska and the Yukon territory. Although the nesting ranges of the hermit and Townsend's warbler prototypes overlapped in the Pacific Northwest, ^{where the present species now} they did not hybridize, but maintained their distinct identity. ^{Townsend's} The last and smallest of the emigrating groups, the ancestors of the golden-cheeked warbler, extended their range only as far as the dry Edwards Plateau in Texas, where they adapted to an oak-^{cedar} juniper association not unlike the one inhabited by the black-throated gray warbler in New Mexico.

In pattern the plumages of the black-throated gray and Townsend's warblers are almost identical, the difference being that where the former is white the latter is yellow. The black auricular patch in these two species is reduced to an eye-stripe in the black-throated green and golden-cheeked species, both of which are distinguished by having golden cheeks; but the crown and back feathers are greenish in the one and black in the other. The

hermit warbler is like the black-throated gray except that it has an all-yellow head. All five species have black throats, and in all but the Townsend's the breast is white. These descriptions apply, of course, to the males of the species. A similar evolutionary process has been proposed to account for the differences between the myrtle ^{warbler of the East} and Audubon's warbler, its Western counterpart, which is found nesting in the spruce forest at altitudes of from nine to ten thousand feet in the Sangre de Cristo range of New Mexico. Among the birds that find a favorable habitat in the relative humidity of New Mexico's dark mountain canyons is MacGillivray's warbler, the Western counterpart of the mourning warbler found in Minnesota, but distinguishable in having white eyelids—a feature most notable in the male. Building their nests in the wild currant bushes that border the ephemeral mountain brooks, warblers of this species are no less shy and secretive than their Midwestern relative. At higher altitudes, where the pinon-juniper forest is replaced by a mixed growth of Gambel's oaks and ponderosa pines, warblers of three species occur in limited numbers. The Virginia's and orange-crowned warblers nest on the ground in thickets where the oaks are most stunted, and Grace's warbler is found nesting in the pines. I have seen the latter more often than the other two but have never found its nest, whereas by a combination of luck and hard work I have found and photographed both the Virginia's and the orange-crowned species. Of these two the Virginia's is the more common; in fact, I have never seen more ^{nesting} than one pair of the orange-crowned warbler. To find their nest, I devoted the better part of a week after I first heard the male singing from the top branches of the tallest Gambel's oaks growing on a steep, gullied slope. For almost a quarter of a mile he ranged across the mountainside, staying always on the same contour, voicing his feeble trill repeatedly from the same high perches for minutes on end. Any

of the singing posts, I knew, might be close to the nest, and I searched for it on hands and knees in the oak thickets. If I could flush the female, the search would be over, or nearly enough so that she would reveal herself by her scolding. Then, if only I could keep her in sight until her alarm subsided, she would inevitably reveal the location of her nest. Or so I thought; but the strategy proved futile. For hours, day after day, I watched the male from various vantage points as he moved about his territory, singing always from the same stations, but I never saw him joined by his mate. Soon nothing else mattered but to find that nest—to photograph this bird above all others became an obsession. Mentally recapitulating all the evidence for the probable locations of that nest in the territory over which the male bird roamed, I reappraised all my assumptions and started over again from the beginning. Finally, it was ^{by adopting} the hypothesis that what appeared to be his singing territory could not be synchronized with the breeding territory that my persistence was rewarded. Early one morning, a week after I had first heard the male singing, I wandered well beyond the boundary of the area he seemed to have outlined, and from across a small ravine I saw a small bird fly to the ground under a low flowering shrub. It did not fly up again, and while I pondered the meaning of this, the male orange-crowned warbler appeared on an oak close by. This time he did not sing; but presently the bird that had disappeared under the bush ^{All but} flew out and joined him. ^{certain} that here at last was the nest I had searched for so long, I crossed the ravine without haste—for I did not want to be too soon disappointed—and there it was: ^{placed} well underneath a buckthorn bush covered by clusters of small creamy blossoms, surrounded by dried oak leaves. The five small eggs, wreathed at the larger end with speckles of brown and purple, were unmistakably those of a warbler.

My discovery of a Virginia warbler's nest, similarly placed under a seedling oak on the same hillside, took place in much the same way. This time I was looking down across a wide ravine when I saw a bird drop down from a pine tree into some low, scraggly oaks. ~~Instantly~~ I thought little of this until, as I continued to study the hillside, I saw the same thing happen again. An occurrence such as this is rarely by chance; so I focused my glasses on the oak clump, from which I soon saw a bird emerge--a gray warbler that could be nothing but a Virginia's. As I continued to watch, I saw her return a third time, carrying something in her bill. Now there could be no doubt that she was busy ~~with~~ building a nest. As irresistible curiosity overcame my better judgment, at the risk of causing the bird to desert I crossed the ravine to investigate. When I found the barest beginnings of a nest, perhaps new that very day, I quickly retreated and did not return for a week. When I did so, I was relieved to find a completed nest containing eggs, which hatched in due course, followed by the successful rearing of the young.

Warblers that nest on the ground appear to be more secure than any others from predation by such larger birds as jays and grackles. This has been my observation, at any rate, on Great Spruce Head Island, where the most vulnerable of nesting warblers appear to be the magnolia warbler and the redstart. The nests of such species as the Canada and black and white warbler, on the other hand, seem to goe undisturbed. Placed in a deep recess under a litter of fallen twigs, nestling among the roots of birch or maple, or sunk in a hillock of moss overspread with fern fronds, they are deeply cupped and constructed of materials that are scarcely visible in the undisturbed vegetation, and so well hidden ~~therefore~~ as to be unnoticeable from even a foot or two away. The only hope of finding the nest of a black and

white or Canada warbler is after seeing the parent birds go to the nest with food for their young, or the female returning to incubate her eggs after a brief foraging expedition. Such a nest cannot be found by simply searching the most likely location after spotting a singing male in a tree, as is possible with a species such as the redstart. ¶ In the summer of 1971, while searching an alder bog for a redstart's nest in this manner, I became aware of the scarcely audible scolding by a mousy gray little bird. At first I mistook her for a female redstart, but after a more attentive scrutiny I realized that this was a female Canada warbler, and that she carried food in her bill—a certain indication that a nest containing young was hidden nearby. As stealthily as possible, I followed her movements through the alder thickets. But I lost track of her, and it was only after I had waited a long time without moving that she reappeared, once again with food—only to disappear once again without my seeing the direction she had taken. When the male appeared, also carrying food, I was able to see him drop down to the ground under a leaning spruce trunk, near the foot of a white birch thirty feet from where I stood. Certain that the nest was there, I went over to investigate; but a search all around and under the leaning trunk within a fairly wide radius revealed nothing. Just as I was about to return to my former point of observation, a bird flew out as I placed my hand on one of the birch roots. I had inadvertently flushed the female Canada warbler from her nest, where she had remained immobile all the while. Even then, I did not locate the nest immediately. Placed far back in a narrow crevice between smaller roots, it was so inconspicuous that at first I couldn't believe it was there. This is the kind of location safest from discovery by a predatory bird.